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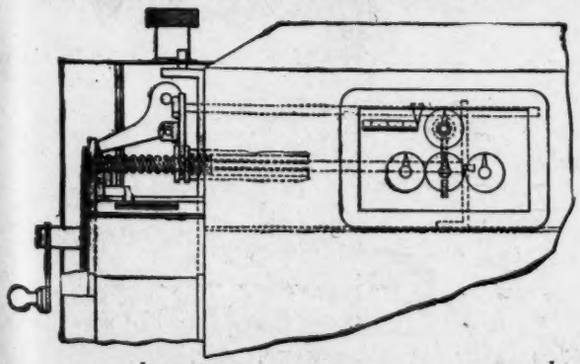

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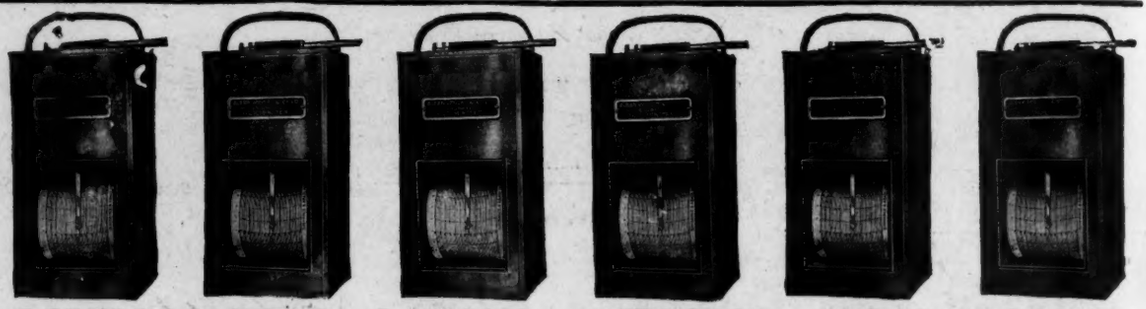

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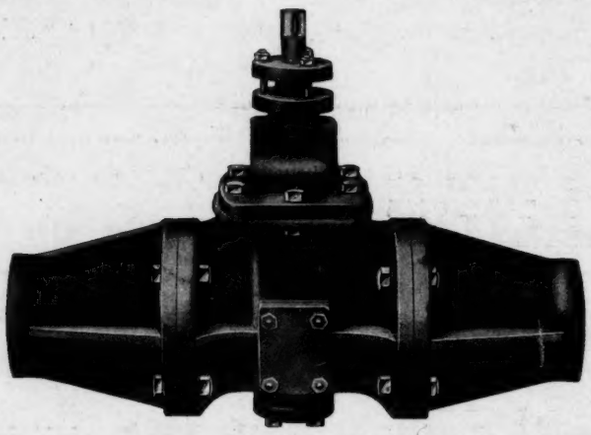

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EDITORIAL NOTES.

A Board of Trade Circular and First Duty.

THE Board of Trade have distributed a good deal of counsel, wise and otherwise, during the war; but their latest effort should take bottom place in the heap labelled "otherwise." The fresh counsel is comprised in a circular issued to gas and electricity undertakings; and it ought to be framed by gas-works owners, with the inscription underneath, "In the "Interests of the Enemy." The receipt of the circular revives the suggestion that it is high time advice and request issued by Government Departments came under some censor competent to make examination from every plane and every side, in order to ascertain whether on balance advice or request is actually for or against the interests of the country. If this had been done in this instance, the ridiculous solicitation of the Board of Trade to the gas industry would never have been distributed; and the Board would never have let themselves into the undignified position of dancing to the wire-pulling of the colliery owners, and acting against the national interests for their benefit.

The request is that the owners of gas and electric lighting undertakings should "notify their consumers that the "Government desire to see the consumption of coal for "lighting purposes reduced by 10 per cent., and that they "should do all in their power to see that this notification is "carried out." The electricity people can look after themselves. Our business is with the request as its affects the gas industry; and the Board may as well be informed at once that, so far as the gas industry is concerned, national duty forbids the request being complied with. Looking at the matter first from the practical standpoint, we wonder how the Board arrived at the 10 per cent. reduction. Why not 20, 30, 40, or even 50 per cent.? Then we should like to know how the Board would advise gas undertakings to set about seeing that the lighting consumption is reduced by 10 per cent., inasmuch as the consumption for all purposes in almost every place is registered through one meter. A considerable proportion of the gas consumers, too, are of the prepayment order; and many of them only use one light in the living room during the evening. A reduction of the consumption of coal for gas-lighting purposes by 10 per cent. means a diminution of the lighting by 10 per cent.; and how this is to be accomplished in the homes of prepayment consumers is not explained. The 10 per cent. reduction is only one absurdity of the circular. Another, taken in conjunction with the 10 per cent., is found in the opening paragraph, where it speaks of the difficulties experienced for some time in securing adequate supplies of coal for "manufacturers of munitions and other consumers of "national importance, owing to the decline of the output "of coal." What are gas undertakings but "manufacturers "of munitions"—and very highly important munitions too? Shell and bomb cases are of little use without the ingredients for making high explosives; and the maximum provision of high explosives for this country and her Allies (to whom they are in these times as important as coal) cannot be made if the consumption of gas is further reduced. The greater the consumption of gas, the greater the source of the supply of high explosives. Nevertheless, the Board proposes that the consumption of gas for lighting purposes should be reduced by 10 per cent.! We cannot admire the wisdom of anyone who suggests there shall be a lessening of the sources of the supply of benzol, toluol, sulphuric acid, and other chemicals, which are one and all as necessary as men to the prosecution of the war. A still further absurdity is the suggestion of the Board that—in these days of a heavy deficiency of man power in the gas industry through enlistments, of an enormous increase in expenditure (resulting in the price of gas having to go up, and dividends to come down), and of no spare revenue for the luxurious inspection of gas-meters—inspectors should be sent round as often as possible to examine the meters, and keep consumers up to the Board's 10 per cent. economy standard. If the Board will undertake to furnish every gas undertaking with the additional trained meter readers and the necessary clerical staff, and with the wherewithal for their remuneration, they might be able to comply with the request. Already, through shortage of staff, several gas undertakings have had to dispense with monthly or interim quarterly gas-meter readings.

Let it be remembered that the gas industry has already lost a not inconsiderable part of its lighting load through public lighting restrictions, reduced shop illumination, the shortened hours of opening of licensed premises, and the reduced public patronage at night times of restaurants, &c.; and upon all this there will undoubtedly come the summer daylight saving scheme, which will cut down by an hour the period of the domestic consumption of gas for illumination. How much further this process of whittling-down consumption is to proceed cannot be said; but how in the circumstances there is to be compliance with the pleading of the Ministry of Munitions for further benzol and toluol is a problem that we should like to see the Board of Trade attempt to solve. What it comes to is, that these two departments, having different interests in view, are taking courses that are diametrically hostile the one to the other. In view of this, a question that may be asked the Board of Trade is as to which request they honestly consider gas undertakings should give heed—the one for an increased quantity of benzol and toluol, or the one which suggests that the sources of the production of these substances should be reduced by a 10 per cent. proportion of the lighting load of the undertakings? A second question is as to whether the Board regard it as more important in connection with the war that neutral countries should be supplied with additional quantities of British coal, or that this country and its Allies should be kept adequately supplied with high explosives?

Whatever reply the Board of Trade choose to give to these two pertinent questions, owners of gas undertakings have no doubts whatever as to what is their duty to the country. It is to maintain the sale of gas at the highest possible level, in order to render the best possible return in the shape of requisites for high explosives making. If the Board of Trade cannot see that this is the duty of gas undertakings, then the owners of these undertakings are sorry for the Board and their counsellors. Besides gas-works are not as many other large users of coal; they do not destroy coal and all the value it contains for the single purpose of obtaining heat or raising steam. On the contrary, for every ton of coal used, they put upon the fuel market 10 cwt. of coke, and 12,000 cubic feet of gas. The tar, too (after being used for washing the gas), is rich in benzol and toluol, and many other useful substances; the ammoniacal liquor produces the sulphate of ammonia which the Board of Agriculture advise farmers to apply to the soil as much as possible to increase their harvest; and the oxide of iron used for the purification of gas becomes progressively rich in sulphur needed for the production of sulphuric acid. Nevertheless, the Board of Trade think it would be a good thing for the country if 10 per cent. of the coal used for gas-lighting purposes were saved, so that it could be exported to neutral countries! The Board would do a much greater service to the country and her Allies by advising, as other departments have done, householders to burn more gas and coke, and less raw coal. In this instance, we are afraid the gas industry cannot accept the Board as a safe guide in the matter of loyalty to national interests.

What has induced the Board to tender this amazing advice to gas undertakings? They profess some alarm over the decline of coal exports; and they also regard coal as a valuable lever in negotiating with neutral countries. Neutral countries have not done badly since the war started out of British coal supplies. Take March alone, they were sup-

plied with 1,256,931 tons of coal, compared with 1,885,982 tons to France, Italy, the Channel Islands, Gibraltar, Malta, Egypt, and British India. The arguments as to exports and negotiations are plausible; but they will not apply so far as the gas industry is concerned. But how came the Board to arrive at this new-born interest in coal exports and negotiations with neutral countries, seeing that the Coal Exports Committee have the matter in their safe keeping. The Board, it appears, have been advised by the Central Coal and Coke Supplies Committee; the Central Committee are advised and appealed to by the District Coal and Coke Supplies Committees; and the District Committees are composed largely of men interested in coal! Most men interested in the sale of coal do not like the Price of Coal (Limitation) Act; they prefer the freedom of getting what prices they can for coal sent abroad. The Coalowners' Association, it is rumoured, have been pushing this matter in influential quarters for all it is worth. If 10 per cent. of the coal employed in providing gas lighting were released for export (to say nothing of that burned under steam-boilers for electric lighting), the coalowners would receive additional pecuniary benefit. Thus explanation of this fresh move plainly appears to lie in a nutshell. However, the Board of Trade conclude their circular by saying that they would be glad to be informed in due course what steps are being taken in the matter. So far as gas undertakings are concerned, we do not think the Board need be troubled with individual answers; sufficient should be a collective reply to the effect that national duty, and the requirements of the Ministry of Munitions, are more important at the present time than diverting coal from the gas industry to the disposal of coalowners in order that they may derive more profit from customers abroad, which customers may be utilizing some of the coal in the interests of the enemy.

Temperature and New Practices in Gas-Works.

As a measure contributing to evolution and to change, the war is unprecedented; and its effects upon the fortunes of nations and industries will be universal. Already the gas industry has found that it has not escaped changes in practice which unerringly point the way to expansion of the direct utility of gas undertakings in the service of man and material progress. We have before emphasized these particular changes, others have done the same, and Mr. Geoffrey Weyman, M.Sc., of the Newcastle and Gateshead Gas Company, dressed them with fresh thought and experience in the paper that he read last Saturday at the meeting of the North of England Gas Managers' Association. Prior to the war, benzene, toluene, and xylene were produced by tar distillers and the distilling plants owned by a few gas-undertakings and coke-oven owners; and the war, with the sudden cessation of commercial relations with Germany, found us very ill-furnished with stocks of these commodities. Yet for many years—ever since the incandescent burner came to take an illuminating part in human affairs—much larger supplies than were previously available of these constituents highly valuable in war and in peace have, to all intents and purposes, been recklessly destroyed. There are no other words for it when, by the partial removal of the benzenoid hydrocarbons, the calorific value of gas is only depreciated by about 3 per cent., and when by their complete removal the calorific value is only diminished by about 8 per cent. There is, under such circumstances, no justification for a continuance of the waste; and the longer the war lasts—we do not want its terrible tale to be prolonged a day for this purpose—the more accustomed will gas men and consumers become to conditions which are indubitably destined to have an important bearing upon the future work of the industry.

We have long since by instruction and experience learned that efficiency in the extraction from gas of the constituents in question is very largely a matter of temperature; and, after reading Mr. Weyman's paper, one is inclined to ask whether the utmost is being done that might be done in removing *ab initio* by the tar the benzene, toluene, xylene, &c. It does not require much knowledge of the physical conditions to appreciate that the higher the temperature at which the tar is separated from gas, benzene is present in the purified gas to far greater extent than if the tar and gas were allowed to cool together. When a high standard of illuminating power was compulsory, the separation of the tar at a high temperature was an advantage; but now, when a high illuminating power gas is not only unnecessary but useless, and the components that went to supply a constitution essential to high illuminating power have larger practical value in other spheres, the removal of the tar at lower temperatures than formerly is a benefit. The tar removal of the benzene and toluene could not be conducted with greater efficiency than by the generally adopted process, under which the tar is cooled, and is then specially brought into contact in scrubber or washer with the gas which has also been cooled; and the lower the temperature, the greater the concentration of the benzene and toluene in the tar. But, however efficient the tar process—this, too, is common knowledge—the complete saturation of the tar from a ton of coal with benzene and toluene would not remove the whole of these constituents from the gas produced from the ton of coal. The maximum efficiency of the process is approximately 50 per cent.; and about 0·15 gallon of toluene and 0·9 gallon of benzene are left in the gas. The point in this connection which Mr. Weyman's remarks and data suggest, and over which there will be at some future time further consideration and perhaps experiment on the part of gas engineers (and even now where the process has not so far been adopted), is as to whether the travel of the gas and tar, and thus their cooling, cannot be arranged before the condensers to an extent that would give an efficiency sufficient to make unnecessary a special tar washing. Of course, the attainment by this means of the same efficiency as in the tar-washing process could not be effected; but Mr. Weyman submits the point for consideration in the passage: "All "the way from the retorts to the condensers, the benzene "and the toluene are coming down from the gas with the "other hydrocarbons which form tar progressively as the "temperature decreases; and if there happens to be such a "long foul main that the tar and gas are already cooled "when they are separated at the condensers, extra washing "will not be of much benefit." Supplementing this, cold tar from the well could be circulated through the foul main, and thus, to an extent, increase the extraction of the required hydrocarbons.

However, the adoption of an extended cooling of the gas and tar prior to the condensers, so that the former would part with a larger proportion of benzene and toluene to the latter, can hardly be entertained as sufficient at the moment; seeing that the Ministry of Munitions are urging the industry to provide more benzene and toluene, and this is not to be accomplished by adopting (of course, Mr. Weyman is not suggesting that it shall be at present adopted) a system in any way inferior to the special tar-washing process. To do better than at present means the application of the system of washing by (say) creosote, which raises the efficiency of extraction at a bound to about 90 per cent., annihilates the illuminating power, and reduces the calorific value by about 8 per cent. This 8 per cent. reduction in calorific value is about the extent that the gas at Southport suffers washed with American gas oil [see "JOURNAL," March 28, pp. 672, 688]. But the illuminating power in this case is not really seriously depreciated, while the recovery efficiency is, under the system of working, much lower than with creosote oil washing. There is the serious drawback of naphthalene in the creosote oil; and the treatment of this trouble Mr. Weyman discusses. In this connection, it is interesting to bear in mind Mr. Bond's statement as to his experience at Southport, that the American gas oil takes up from the gas a considerable quantity of naphthalene; and, since the process has been in use, only about 5 grains per 100 cubic feet of gas have been found at the inlet of the purifiers. But on the other hand, it will be remembered that, on the same occasion, Mr. E. W. Smith stated that the experience at Birmingham was that toluol extracted by American gas oil contained a high percentage of paraffins, which is a disadvantageous result.

Another point of interest has reference to both the carbonizing temperature and retort system. The low-temperature processes of carbonization and vertical retort working have both been acclaimed as being altogether superior in the production of benzene and toluene. Mr. Weyman contests such claims. Roughly speaking, high heats and full retorts are the most favourable conditions. Too low heat produces paraffins, which spoil the benzol. Too high heat or too much space above the charge will tend to convert the benzol into naphthalene, owing to the radiant heat from the upper surface of the retort; the yield of ammonia being also affected. As to low-temperature processes, these give the primary products of distillation—paraffins rather than the benzenoid compounds. Until, as Mr. Weyman points

out, additional means are made available to convert the former into the latter, or to separate them, there is likely to be much disappointment. Moreover, the retention in the low-temperature produced coke of volatile matter from which useful products can be derived, is not in accord with the economic doctrines of the day. There is also a tendency in vertical retorts to produce paraffins as well as benzenoid compounds; and the recovery of the latter is seriously hampered by the former. Therefore, quantitatively as well as qualitatively, there is much to be said for high temperatures and fully charged horizontal retorts under the condition of pressing need for the benzenoid compounds. Thus we see, too, the important part in every direction that temperature has in the new practices that the war has brought into being in gas-works, and which may (once they have been started) become normal operations.

Organization and Commercial Sections.

"THE lesson of co-operation and co-ordination is being "taught anew on a gigantic scale just now; and an in- "dustry which has everything to gain, and nothing to lose, "by working in this direction cannot afford to neglect any "opportunity of doing so that offers. If a number of "undertakings stand aloof from such work as is referred "to in this paper, the highest possible result cannot be "obtained. *All the forces that can be mobilized are essential "to complete success.*" These words are found in the concluding paragraph of the paper that Mr. Herbert Lees, of Hexham, read before the North of England Gas Managers' Association last Saturday. We have only one point on which to criticize Mr. Lees; and it is that his choice of title for the paper—"The Special Purposes Section"—was not a happy one. The paper deals with something more than that section of the Northern Association and its work; and it has a much larger importance and intention. It pictures the evolution of organization in the gas industry, and scans some of the work, but only some; for the bounds of a contribution of the kind would not permit of more. Therefore readers must not infer that the limited indication of the title comprehends the subject-matter of the paper, which has among the closing words those italicized above—"All "the forces that can be mobilized are essential to complete "success."

These words fasten Mr. Lees to a policy in organization which shall include all those "forces"—all those interests—that have not yet been brought into co-operative action (beyond taking part in the enterprise of publicity) in the general work of the industry. The quoted words, too, complete and set a seal to earlier ones in the paper, declaring: "Whatever the future may have in store in the way of co-or- "dination of the present organizations, or the formation of "another in which the interests of all shall be represented, "it must surely be acknowledged that each has done, and "is doing, excellent work." Mr. Lees does not end there. He adds: "There can be no standing still; and if continuous "development cannot be assured on existing lines, others "must be marked out, and boldly followed." The point is not one simply of "continuous development," which is a matter of degree. It is the maximum possible development that is required; and this can only be assured by the maximum efficiency to be secured by the mobilization of all the forces that "are essential to complete success." We, like Mr. Lees, freely acknowledge that the existing organizations have done excellent work, and, left alone, they would still do so, and would help in the continuous development of the industry. But the question is whether they, limited in their representation, power, and functions, combine to bear upon the interests of the industry in all directions that influence which a fully representative organization would be able to do. The critical periods of the past, the slights that have at one time and another been put upon the industry through the absence of complete authoritative representation, have shown the need for an organization of plenary power and energy; and, as has been said in recent articles in the "JOURNAL," the need of such an organization will be felt more keenly in the future than it has been in the past. Strong representative organizations in other directions must be faced by strong representative organization from our own quarter—and not only in the matter of publicity. The times have changed; and with them requirements. Let this be recognized—not in any mean, prejudiced, jealous spirit, but in that which will show a full and honest loyalty to the best interests of the industry as a whole.

But as to the main part of Mr. Lees' paper. There is no other District Gas Association that is so broad in its constitution as the North of England Gas Managers' Association; and its Special Purposes Section varies from the ordinary Commercial Sections of other District Associations in that it acknowledges by its title that it is prepared to, and does in fact, deal with matters that range beyond those that are purely of commercial character. In the work that has been done by the industry's many organizations as they at present exist, that in the North of England, with its Special Purposes Section, may claim to have had good part. The District Associations and the Commercial (or Special Purposes) Sections have really been of more service to the head organizations than has ever been sufficiently acknowledged. They have acted as district feeders, as stimulating and recruiting agents, and have performed auxiliary work in other useful capacities for the larger organizations to which they are affiliated, or in which the members are otherwise concerned. And not only so, but the opportunities given for private discussion at their meetings exert a beneficial influence in many ways upon the head organizations. From the private discussions at Commercial Section meetings suggestions (distinct from the main objects of such sections) have come that have had a distinguished and healthy effect on the development of the policy of the larger organizations. If Mr. Lees had cared to compile more instances of this, and so enlarged his paper with detail, he could have added to the weight of proof that this was so. But his intention was served by what he did advance. This intention was to show the advantage generally to the district gas undertakings of the Special Purposes Section of the North of England Association; and, in doing this, he coincidently presented the benefit of the work of the Commercial Sections, and of the other organizations of the industry—especially of the British Commercial Gas Association, and the Sulphate of Ammonia Association, both of which, by the way, have a larger constitutional representation of interests than any of the other organizations in the industry, and both show a great deal of energy and power, and this because they are representative, and can speak and act with authority. The Sulphate of Ammonia Association have not, through the war, had full opportunities for the exercise of its activities in the directions that will obtain in normal times; but without the organization in these days of political control, through national exigency, of liberty in various ways producers of sulphate of ammonia would have been in a helpless state. We can, by the conversion of a pronoun from the singular to the plural, apply to the two organizations mentioned a passage which Mr. Lees used in regard to the North of England Special Purposes Section: "Some had great expectations of their value at the outset; "those expectations have been more than realized."

No one who reads with open mind the case that Mr. Lees puts forward showing the value of co-operative effort in the gas industry, can leave it without agreeing that no gas undertaking, no matter its size, ought to remain unidentified with these organizations. There is a duty as well as an interest. Unity of brains, of power, and of money, gives strength; and this strength in the gas industry we cannot afford to despise, and certainly cannot afford to do without. If it can be increased—and there is forcible demand for increase in the experience of the past, in the expanding interests, in the greater competitive thrusts at these interests, and in the pressure in commercial and parliamentary spheres—by establishing a central organization fully representative of interests, then steps ought at once to be taken to establish it. The times disclose to us that such an organization is wanted; but, if developed, the counsel and aid of district organizations and their offsprings will be required as much as, and even more than, ever. For the third time, we reiterate Mr. Lees words: "All the forces that can be "mobilized are essential to complete success."

Reported Travancore Thorium Development.

Under this heading, in the "JOURNAL" for March 21 (p. 624), reference was made to what purported to be a development of the Travancore Minerals Company, under the title of the Nitrate of Thorium and Bye-Products Company. By this, it appeared that the Travancore Company, or certain of the Directors (with others), were contemplating becoming not only suppliers of the Indian monazite sands, but, by the promotion of a separate Company, buyers of the sand, which the new Company would convert into

thorium nitrate. By this means, it looked as though the Travancore Company would indirectly obtain complete controlling power of the thorium position in this country, and so effectually prevent other makers commercially competing. It now seems that all this was premature, and alluded to something in embryo. The sequel to the story as to the development was told last Friday in the Chancery Division before Mr. Justice Sargant, when Mr. W. H. Nockolds apologized to Sir John Prescott Hewett (who is the Chairman of the Travancore Company by direction of the Secretary of State for India), and two other Directors, Mr. Hugo Hirst and Sir David Yule, for an unwarrantable use of their names in connection with the proposed Nitrate of Thorium and Bye-Products Company. The defendant also submitted to a perpetual injunction, with payment of the costs of the application. The proceedings in Court will be found reported in our "Legal Intelligence" to-day.

Sulphur in Coal Gas.

The paper on sulphur in coal gas that Professor Frank Clowes, D.Sc., submitted to the London Section of the Society of Chemical Industry yesterday week, skimmed the history of the sulphur question; it included references to old investigation that particularly suited the position in which the author long since installed himself in regard to sulphur in gas; it said little about rebutting scientific evidence advanced by the gas industry; it alluded somewhat slightingly to the practical testimony of everyday experience; it mentioned approvingly the catalytic process developed by the South Metropolitan Gas Company (of which the London Section of the Society already knew through the paper of some time since by Mr. E. V. Evans, and the published work of the Chairman of the Company and President of the Society, Mr. Charles Carpenter, D.Sc.); and it wound up by advising the gas industry to quickly avail itself of the process which is now rendering such excellent service in the South of London. We are firmly in sympathy with the view that sulphur in gas should be brought down, by any practicable process, to an innocuous point, but are strongly averse to anyone presenting a case which would lead the uninitiated or the credulous to believe that the whole gas industry, save the one undertaking where the catalytic process is in operation, is distributing gas that is doing untold mischief under the circumstances of modern use.

Facts and Critics.

The great point about the inquiry of a dozen years or so ago is that a highly competent Committee, after all the evidence referred to, recommended the relief of the Metropolitan gas undertakings from the restrictions as to sulphur compounds other than sulphuretted hydrogen, and Parliament has since consistently confirmed the recommendation when asked to do so. During the dozen years, too, the gas industry itself has not stood still in the matter of gas purification. More attention is now paid to it; and, under the simplest forms of purification, a higher level of purity is now achieved than formerly. The catalytic process with its result of a residual sulphur content of something under 8 grains per 100 cubic feet [Mr. H. E. Jones at the meeting also spoke of a system of working which leaves the remnant sulphur at about 6 grains per 100 cubic feet] marks the advanced stage to which auxiliary method enables purification to reach. Gas engineers are not (as Professor Clowes apparently believes them to be) oblivious of the interests of the gas industry; and these interests would not be served by them spreading destruction wherever gas is used. The fact remains that since the inquiry of a dozen years ago, the business of the industry has had considerable expansion. Of course, there are engineers and engineers; there are chemists and chemists; there are fanatics and there are other people in the world; and there are those who obstinately decline to remould opinion in the light of current work, use, and experiences. The chemical critics of the gas industry are not those who have intimate knowledge of its manufacturing processes, and of the application and real effects of the use of the primary product. And those chemists who are the most persistent critics are those who have done the least in the shape of material work to help the industry forward along the road of improvement in process. Mr. Carpenter and Mr. Jones, in the discussion on the paper, had a dig at these chemists; and Mr. Jones, Mr. W. J. A. Butterfield, and Dr. Samuel Rideal all had something to say which did not allow Professor Clowes' points as to harmfulness to pass unchallenged. Their remarks could be extensively supplemented; but supplement is to-day unnecessary.

The Safe Naphthalene Limit.

From a short report in other columns, it will be seen that, at last week's meeting of the London Section of the Society of Chemical Industry, Mr. J. S. G. Thomas, B.Sc., of the South Metropolitan Gas Company (author of the article that appeared on pp. 701-3 of our issue for Dec. 28 last), read a paper on the "Evaporation of Naphthalene in Dry and Moist Coal Gas." In the discussion, Mr. Charles Carpenter, D.Sc., the President of the Society, mentioned that, when originally the South Metropolitan Gas Company's staff looked into the question of naphthalene removal from gas, they, on the work of Allen, came to the conclusion that if the naphthalene content could be reduced to 10 or 12 grains per 100 cubic feet, there would be absolute immunity from trouble. Painful experience proved their mistake; and the valuable investigations made by Mr. Thomas had declared that, to be on the safe side, it was necessary to adopt as a standard something like 2 or 3 grains.

Crude Benzol Yield at Manchester.

When the Manchester Institution of Gas Engineers, at the invitation of their then President (Mr. J. G. Newbigging) visited the Bradford Road Gas-Works of the Manchester Corporation, they saw under construction, among other things, a Simon-Carvès plant for the oil-washing of gas for the recovery of crude benzol. Some particulars of the plant (which has a maximum capacity equal to the treatment of 8 million cubic feet of gas per day) appeared in the "JOURNAL" for Nov. 2 last (p. 250). When the Manchester Junior Association visited the place on Saturday, they found the plant is now at work so far as the gas washing and the rich oils distilling operations are concerned; but the second and third distillations have had to be deferred owing to the temporary shortage of steam. However, it is expected that these will be at work in about three weeks' time. The gas washing plant has quite come up to expectations; the yield of crude benzol being the excellent one of 4 gallons per ton of coal carbonized. Has such a result been obtained anywhere else in connection with gas-stripping? If so, we should like to hear of it. Anyway, the figure speaks volumes for the quality of gas made at Manchester.

The Deputation Question.

The deputation question, like the poor, and the demands for a share of municipal trading profits in aid of the rates, we have always with us. It has cropped up again at Wigan, in connection with a proposal of the Chairmen of the Manchester and Salford Gas Committees that a conference of representatives of large gas undertakings should be held, in view of the probable shortage of coal supplies next winter, and the difficulty of satisfactorily arranging contracts at this time. A more important matter than this at the present juncture, it would be difficult to imagine; and the Wigan Gas Committee approved of the idea of a conference, and resolved that the Chairman, Vice-Chairman, and Gas Engineer be authorized to represent the Committee on the occasion. One would have thought this was a proper enough attitude to adopt; but it was challenged in the Council, by a member who "did not think there was anything of any serious importance that would be brought up at the conference requiring the attendance of three representatives of the Council." Wigan must occupy a singularly fortunate position if it can afford to take so self-satisfied a view as this of the coal question. Another ground of objection was that "certain members of the deputation were prepared to pay their own expenses." This would, in some circumstances, have been a little more reasonable attitude to take up than the other; for it is self-evident that, if the business of the town is of sufficient importance to warrant the attendance of delegates, the town should assuredly pay for it. The fact, however, that the Chairman and Vice-Chairman of the Committee are frequently in Manchester (where it is proposed to hold the conference) on their own business, and might combine the two things, robs the objection of some point in this connection. The Mayor, during the debate, gave a useful hint to the Gas Committee, by remarking that if he had been the Chairman he would have gone to the conference, and not have put the resolution on the minutes. Reading through the long discussion which took place, it seems that the stand made by the objectors was the result of what was said by other members in regard to a previous deputation—under totally different circumstances. It

would have shown more wisdom had some other occasion been selected for protest; but it is gratifying to find that good sense prevailed in the end—the amendment being withdrawn and the minutes confirmed.

Daylight Saving Scheme Practically Assured.

Parliament is probably discussing the question of daylight saving as this issue of the "JOURNAL" is being printed; but it may already be accepted with a large amount of certainty that, before we are much older, our clocks and watches will have been put on by one hour, and that we shall be utilizing from now to October an hour more daylight by the transference of an hour from the period of sleep to the period of activity. The matter is being discussed on this occasion not on the ground of health, but on that of economy; and this touches the gas industry very closely. In fact, the terms of the motion tabled by Sir Henry Norman for the consideration of the House suggests no other reason for the alteration of time than that "economy in fuel and its transport would be effected by shortening the hours of artificial lighting." This is not pleasant to contemplate under the already restricted use of gas and electricity for lighting purposes; but it is no use in these times protesting against an automatic method of this kind of securing economy, although (as pointed out in an editorial article to-day) all reduction of gas consumption proportionately lessens the ability of the gas industry to supply the Ministry of Munitions with benzol and toluol. What cannot be helped, and what is a necessity, must be endured. Public opinion has changed immensely over this matter. What was regarded at one time as fantastic is now looked upon as quite feasible. The Home Secretary (the Right Hon. Herbert Samuel) has intimated that it is probable the Government will at once accept the proposal. The Coal and Coke Supplies Committee are in favour of it; so are the Railway Managers' Committee, Chambers of Commerce, retail traders, municipalities, and others. As pointed out last week, many of the Continental countries have adopted the scheme. Reports from Holland say the people of that country are very pleased with the extra hour, and information from Germany asserts that no complications have arisen there.

Yorkshire Junior Gas Association.

A meeting of the Association took place on Saturday afternoon, at the Leeds Institute of Science, when Mr. J. E. Lister Cooper, of Yeadon, read a paper descriptive of the Yeadon and Guiseley Gas Company's undertaking, and the old and new plant installed there; and this was followed by a lengthy discussion. Unfortunately, the late receipt of the MS. of the paper has necessitated the holding over until next week of our report of the proceedings.

A Further Revised List of Certified Occupations.

Though as recently as the 11th ult. a considerable amount of space in the "JOURNAL" [pp. 93-4] was taken up with those portions more particularly interesting to our readers of a revised list of certified occupations, that one has now been superseded by a further revised list. From this, the occupations marked in the previous list "M.M." have disappeared. When an age limit for exemption is stated in the new list (May 1), the age referred to is the age at the date of the previous list (April 4). That is, men who had not reached the ages stated at that date are not covered, and do not become covered by reason of subsequently attaining the specified age. There are some new age limitations in the latest list, which are shown in heavier type. The cases of men who have entered coal mines since Aug. 15, 1915, are being considered by the Special Mining Courts. A certificate held on March 1, in connection with an Admiralty, War Office, or War Service badge, is, while it remains in force, a certificate of exemption under the Military Service Act, 1916; and a man holding such a certificate need not ordinarily apply for a certificate to the Local Tribunal on grounds connected with his employment. After May 1, any man, whether attested or unattested, who rightfully holds a badge certificate, at whatever date it was issued, should be marked as exempted in the Military Classification Register, on satisfying the recruiting officer that he holds a badge certificate; and, when so marked, the man is not to be called up for service with the Colours without the consent of the Ministry of Munitions. The provision relating to the production on demand of exemption certificates contained in the Second Military Service Bill will be found on p. 289.

An agreement has been concluded with Mr. Clifford C. Paterson, principal Assistant in charge of Electro-Technical and Photometric Buildings at the National Physical Laboratory, to join the Osram-Robertson Lamp Works, Limited, as Director of Laboratories for Research and Technical Manufacturing Purposes. The arrangement will commence at the conclusion of the war, or before that date, if possible.

OBITUARY.

The death occurred recently, at Bradford, of Mrs. ELLEN NIVEN, wife of Mr. John Niven, Gas Engineer. Mrs. Niven was 82 years of age.

Mr. EDWARD JACKSON, F.I.C., F.C.S., Alkali Inspector for the Midlands, whose death is announced, was a well-known figure in Midland scientific circles. He began life as an analytical chemist, having been trained at Owens College, Manchester.

PERSONAL.

The Secretary of the Society of Chemical Industry, Mr. C. G. CRESSWELL, has resigned; and the Council have appointed Mr. T. F. Burton (the Editor of the Society's "Journal") to act as Secretary *pro tem.*

At a meeting last week of the Directors of the Derby Gas Company, Mr. J. W. NEWBOLD, J.P., was appointed Chairman, in succession to the late Colonel G. Gascoyne. Mr. W. WOOLLEY was elected Vice-Chairman.

Announcement is made in the "Co-partnership Journal of the South Metropolitan Gas Company" of the retirement of Mr. C. T. DRUMGOLD, the Chief Storekeeper of the Company, and at one time an Employee-Director.

Hearty congratulations to Mr. WALTER T. DUNN (the Secretary of the Institution of Gas Engineers) and Mrs. DUNN, who are to-day celebrating their silver wedding. The marriage of Mr. Dunn and Miss Minnie Boot was solemnized on May 9, 1891, at Christ Church, Westminster Bridge Road.

In consequence of the death at the front last March of Lieutenant C. V. TOWNSEND, the Engineer and Manager of the Hereford Corporation Gas-Works, it has been decided that Mr. ARTHUR ROBERTS shall continue as Acting-Manager at £150 a year, until the end of the war. The position will then be thrown open.

In succession to the late Mr. Edward Allen, jun., as Superintendent of the Linacre works of the Liverpool Gas Company, Mr. T. N. GODDEN has been appointed to the position. Mr. Godden's post as Superintendent at Wavertree has been filled by the appointment of Mr. JOHN CHARNLEY, the Superintendent of the Caryl Street works; while the latter's position has been taken by Mr. W. FLETCHER, of the Engineer's Department of the Company, who goes to Caryl Street as Acting-Manager.

On the death of Professor Vivian B. Lewes (Chief Gas Examiner of the City of London), it will be recalled that the Court of Common Council, acting upon a recommendation of the General Purposes Committee, decided that the office should not be filled, but that an expert adviser should be retained for gas purposes—the work of the office in Whitecross Street to be placed in the hands of Mr. W. W. Duffield, the Senior Gas Examiner. Acting in accordance with this decision, the Corporation have now retained Dr. FRANK CLOWES, late Chief Chemist and Gas Examiner to the London County Council, as their expert adviser on gas matters.

The Gas-Furnace Book.

The 1916 edition of the "Gas-Furnace Book," issued by Messrs. John Wright and Co., of Birmingham (with whom, of course, are now associated Messrs. S. N. & E. R. Brayshaw), illustrates a quantity of gas-furnace apparatus which is at the present time in widespread use in munition works and other large industrial establishments throughout the country, though a comparatively small selection of the furnaces they manufacture is shown. Were a complete list attempted, indeed, it would be an impossible task to keep it up to date, so constantly are the firm devising new appliances for melting and heat treatment of metals. With so much useful apparatus presented, specific reference to all is impossible; but particular attention may be drawn to two specialities described. The first of these is the air-blast crucible metal-melting furnace equipped with the new patent Wright-Brayshaw burner. These burners use gas at ordinary pressure, with an air-blast at a pressure of 3 lbs. per square inch; and it is stated that in actual work, "not a fancy test," a furnace with this burner has melted brass with the very low gas consumption of under 1½ cubic feet per pound of metal melted. The tests were taken over four actual ordinary working days in January last, at a brass foundry in Birmingham; and in the best melt obtained during the period of the tests, 45 lbs. of brass were melted in 15 minutes, with a gas consumption of 67 cubic feet, or 1·49 cubic feet of gas per pound of metal melted—which is claimed to be a lower result than anything hitherto on record. The second speciality selected for mention is Wright's "Lopress Regenerative" annealing furnace, in which a "reducing," "neutral," or "oxidizing" atmosphere can be secured at will. The "greasy" flame so desired for annealing operations can be produced to perfection in this furnace, which uses gas at ordinary pressure, and air at from 2 to 4 inches water-gauge pressure, so that only a fan is required. The air supply, it is said, is subject to true regenerative action; and the attainment of temperatures of 1400° C. (2550° Fahr.) is easy. The furnace is heated-up remarkably quickly.

ORGANIZATION OF THE GAS INDUSTRY.

EXTRACT FROM THE PROCEEDINGS OF THE COUNCIL OF THE INSTITUTION OF GAS ENGINEERS, APRIL 27, 1916: "The subject of organization in the gas industry was introduced for discussion, and it was resolved to call a special meeting of the Council at an early date to consider the matter."

[COMMUNICATED.]

AT this important moment, a review of the situation is both interesting and opportune; so turning to the annual meeting of the Institution in 1910 the writer finds an able and vigorous exhortation which should be of value to the Council of the Institution in its proposed deliberations. Briefly, the presidential address pleaded for: Improved business methods; a constant quality, composition, and pressure of gas; recognition of the illuminating standard as a factor of the most trivial importance, with eventual abolition; advantages of combined action in matters of mutual interest; a combined industry, composed of units not competing with each other; need for publicity and advertising; necessity for securing moral and financial support from directors; benefits from incorporating financial and secretarial with technical; illogical position arising out of the Commercial Sections of the affiliated District Associations; and, finally, the need for "a powerful and numerically strong body, thoroughly representative of the various interests concerned, and therefore particularly well calculated to secure the co-operation of the various officials, and the consequent confidence and financial support of the companies and undertakings they serve."

It may be noted that the presidential reference to the paper read by Mr. Goodenough at the Dublin meeting in 1907 can be applied in some measure to the 1910 presidential address; but let us hope that cultivation has rendered the soil somewhat more fertile during the past five or six years. The excellent quality of of the work (and different work, too) performed by the "B.C.G.A." everybody is prepared to admit.

The Association was founded to promote commercial prosperity by co-operative action; to facilitate the interchange of information and ideas respecting commercial development; to develop and improve commercial methods; and to engage in a campaign of advertising and publicity. Why its work has been hedged-in and confined to the narrower path of advertising and publicity, the Institution may perhaps best explain. But it must be confessed that subscribers were attracted by its broader objects, and answered the call for moral and financial support. A stronger call now comes from those giving the support; and there can be but one answer to it. There must be real (and not paper) co-operation in matters which are vital to the industry's welfare; and there are men in the industry who must see to it that apathy is a thing of the past, and that business matters are not retained by those least suited to deal successfully with them. Retrogressive minds on this point may perhaps be influenced by the morals of three fables:

First: Good things have their degrees, and that which is most necessary and useful must be allowed a preference over the other.

Secondly: Facts are stubborn things; truth will out, and those who struggle against it may appear successful for a time, but will in the long run have to succumb to a greater power than themselves.

Thirdly: However strongly entrenched we may think ourselves, as long as money is in the case, it is good to look about for fear of a surprise.

Any business venture constantly in touch with highly-organized bodies, autocratic departments, and parliamentary committees, struggling at times almost for existence, and continually so for its welfare, should dispose its actual and intelligent forces to the best advantage. Is this being done?

In 1912, the Institution reported upon the deliberations of a Special Committee appointed to inquire into the pleadings of the 1910 presidential address—the Committee consisted of all the Council with thirteen co-opted members. The following is a synopsis of their findings (apparently not unanimous): "That the time was not opportune for making any such recommendations to the members as those indicated in the resolution of 1910"—the main reason being that "the proposal then assuming definite shape for the formation of a body representative of the industry generally, but more particularly charged with commercial and propaganda work, it was felt to be most impolitic to advance any suggestions bearing in the same or similar direction until the publicity proposals had either matured or had failed to gain the requisite support."

Thus came the infant "B.C.G.A." His parents inspected him a little later, thought well of him, and while deciding that his should be a business career, agreed that so far as they were concerned no useful purpose would be served at the then present time by altering their constitution and basis of membership, or at any rate until the infant had been given ample time to justify his existence—adding that "the Institution will best serve its purpose by retaining its identity as a technical organization for the present."

Here is a most illogical situation. The principal officers of a gas undertaking are technical managers and business managers—the chairman usually by training a business director. The aims and objects of a technical body are separate and distinct from those of a business body (*vide* organization of colliery interests); so that the technical body not only sacrifices the interests of the industry to the whim of personality, but is destructive too.

Now and again we hear of outsiders knowing more of the gas industry's conditions than those inside who have the shaping of them. The Institution cannot be immune from similar reproach if it professes to be representative of all needs. The works manager of a little undertaking may be eligible for Institution membership by virtue of his technical training, while the business manager, through the mere accident of title, is not, even though the business manager's concern sends out as much gas in a day as the little concern does in a year. Thus the Institution, as it is, cannot be representative; while the "B.C.G.A." is only nominally representative when told that things lying directly within its province must not be touched.

The Institution's and Association's constitution respectively include (*inter alia*) the following:

INSTITUTION.	ASSOCIATION.
"To promote the advancement of the gas industry in all or any of its branches."	"To promote the commercial prosperity of the gas industry by co-operative action."
"To enable persons who are or have been engaged in the conduct of gas undertakings or who have been regularly educated as gas engineers to meet and to correspond."	"To enable persons who are or who have been engaged in the conduct of gas undertakings or in industries connected with the gas industry to meet and correspond."
"To facilitate the interchange of ideas respecting improved methods of administration in gas undertakings, improvements in the manufacture and distribution of gas, its application to lighting, heating, production of power, and other purposes, and the construction of gas-works and other appliances."	"To facilitate the interchange of information and of ideas respecting methods for the commercial development of the industry."
"To conduct or promote investigations into all or any of the matters aforesaid, or any matters connected therewith."	
"Generally to aid, promote, and encourage the acquisition and diffusion of knowledge concerning the production, application, and distribution of gas, the conduct of gas undertakings, and all related matters."	
"To invite from the members and others communications relating to gas engineering, manufacture, and administration, and to receive, hear, and discuss such communications at meetings of the Institution or elsewhere."	"To invite from the members and others communications relating to the commercial aspects of the industry."
"To improve and elevate the technical and general knowledge of persons engaged in, or about to engage in, the profession of gas engineers or managers."	"To develop and improve the commercial methods of those engaged in the industry."
"To . . . assist any association and institution incorporated or not incorporated with objects altogether or in part similar to those of the Institution, and not being a trade union."	"To amalgamate or enter into partnership or any joint-purse arrangement with any society having objects altogether or in part similar to those of the Association."
"To do all such other lawful things as may from time to time be incidental to or conducive to the attainment of the above objects, or any of them, provided that the Institution shall not impose on its members or support any regulation which, if an object of the Institution, would make it a trade union."	"To do all other lawful things incidental to or conducive to the attainment of the objects of the Association."

By "R."

THE articles in the "JOURNAL" on the great need of "Central Organization" not only for the present but also the future requirements of the gas industry, are most opportune; and the matter ought not to be allowed to drop as has happened on previous occasions. The need is too urgent. Since the commencement of the war, questions have been continually arising which have brought most forcibly before administrators of gas affairs the need of such an organization; and the following are some of such matters—though not by any means an exhaustive list—which have had to be handled by one undertaking known to the writer, and in connection with most of which items the existence of a central organization representing the whole industry would have been of the greatest benefit—not only to the particular gas undertaking but also to the majority of the gas undertakings of the kingdom.

Re-arranging of tar contracts, with regard to which an unsuccessful attempt was made at united action, but the authoritative organization was missing. War bonuses to workmen

and staff. Badging of workmen and staff and the retention of essential men. Female labour in the various departments. Restriction in the supply of gas appliances to consumers. Advances in prices by makers of appliances. The appeal just made by the Board of Trade for consumers to be circularized with a view to reducing lighting. Recovery of substances for high explosives. Restriction of licences for coke and sulphate of ammonia. The obtaining of adequate supplies of coal—a very pressing subject at the moment—and the proper carrying out of the Price of Coal (Limitation) Act. Shortage of coke in some districts and large surpluses in others. In regard to parliamentary matters, the obtaining by gas companies of the benefits of the Statutory Redeemable Stock Act, 1915, which has been denied to gas companies generally, and the principle of redemption out of revenue to those companies applying for such powers in the present session for no sound or logical reason, while the principle has always been forced upon municipal undertakings. The obtaining of larger proportions of borrowing powers enjoyed by many industrial concerns. Pressure by county councils and railway companies to alter the general law as to roads to the detriment of gas undertakings. And, finally, pressure by the Residual Products Associations which Parliament seems to be protecting at the expense of gas undertakings.

It is true that some of the above items have been dealt with by Associations partially representative of the industry; but efforts by a truly representative Association would most probably have been much more successful.

During the continuance of the war the need of a central organization will be felt still more acutely; and particularly next winter will the affairs of gas undertakings be much more difficult than hitherto.

The need of such an Association will not pass away with the conclusion of the war; for much that has been customary in the past will require to be looked at from entirely different points of view, and necessitate combined action and uniformity of method, if the best interests of the industry are to be secured.

Now, when the need is so greatly felt, is the time to go forward, and not procrastinate any longer.

ELECTRICITY SUPPLY MEMORANDA.

USERS of Diesel engines for electricity generation are not in happy case just now, owing to the price of residual petroleum. So they have been considering the utilization of tar oils; and engines are being altered. But the discomforts of Diesel engine running include explosions, which are very mischievous not only to the engines themselves and their environment, but to human life. There seems to be a fair amount of mystery surrounding these explosions. Investigations into them generally result in what are hoped to be intelligent explanations; but no one seems prepared to assert that they are unchallengeable. Through the recent bursting of a Diesel engine compressor at the station of the Smithfield Markets Electric Supply Company, one man was killed, and another was injured. An investigation was instituted, and a report was made by Mr. P. H. Smith to Lloyd's underwriters, who have allowed the report to be considered by the Diesel Users' Association. The document shows clearly the difficulty of making research into the occurrence; but there can be little doubt, on piecing together the evidence of the facts, that Mr. Smith got on the right track. It seems that the air-compressor of the Smithfield engine comprised four cylinders—two low-pressure, one intermediate, and one high-pressure. The intermediate pressure plug is, so to speak, inverted, and receives the excess of lubricating oil, which, when the engine is standing, collects in the inverted piston, and can in actual practice get past the piston-rings into the cylinder itself. These rings are forced tight against the cylinder walls, not merely by their own springs, but by air pressure behind the rings; the air being conducted thereto by four small holes communicating from the inside of the cylinder to the ring grooves. It appears that this construction greatly facilitates the ingress of the oil to the intermediate pressure cylinder when the engine is allowed to stand. As seeming to corroborate that the oil actually takes this path, it is worthy of note that these holes soon choke-up. In the case of the Smithfield compressor, two of the holes out of four were actually choked. Further evidence of the ingress of oil in this manner is supplied by the extraordinary condition of the high-pressure valves, which were both heavily carbonized in thirty hours' running.

Diesel Frailties.

Gas-engineers will be interested in these particulars as to one of the several frailties of the chief among the liquid fuel competitors of the gas-engine, and the type of engine that is making a bid for the gas-makers' tar oils. From Mr. Smith's detailed report, we gather that what happened in the Smithfield accident was that the intermediate purge pot burst. An extraordinary pressure must have been exerted to have caused the rupture of the pot. It was constructed of average-quality iron, and of even thickness. Assuming a tensile strength of 7 tons per square inch, its bursting pressure would be about 2400 lbs. per square inch. Hence no pressure normally prevailing in the compressor would be likely to cause its fracture. Mr. Smith submitted that the pressure originated from the spontaneous ignition of oil vapour in the intermediate purge pot. He defined this particular example of spontaneous ignition as the inflammation of oil vapour and air by internal or self-contained means; the temperature necessary to produce ignition arising from the heat resulting from the compression of the air in the intermediate pressure stage. Providing the oil is very finely divided, it might combine with oxygen with sufficient rapidity to cause it to ignite, notwithstanding that the surrounding temperature is well below the ignition point of oil vapour. Among the evidence he found of an ignition explosion having occurred was a black deposit on an otherwise clean fracture of the purge pot, and some sooty deposit in the pipes communicating with the purge pot. Various recommendations were made by Mr. Smith with the view of attempting to obviate further explosions of this character. He proposed that pressure-gauges should be fitted on both the low and the intermediate pressure purge pots; and these he thinks would give sufficient warning of accruing danger. He also recommended that the holes leading to the intermediate-pressure rings should be plugged. This would probably prevent the oil gaining easy ingress to the intermediate pressure cylinder, and so reduce the heavy carbonization of the high-pressure valves. He would also fit a large relief valve to the intermediate and low pressure pots. It is interesting in this connection to note that a similar accident—the bursting of a purge pot—occurred in 1913, in connection with a 300-brake-horse-power engine at the works of the Hoffman Manufacturing Company. In this instance, it was concluded that the explosion was brought about by high terminal pressure and temperature in the intermediate pressure cylinder, which might have been caused by the high-pressure valves sticking-up. Pressure-gauges and other precautionary means of averting a repetition of explosion were also applied in this case. From all this, it is clear that Diesel engines have not yet arrived at that stage in which absolute safety can be ascribed to them as an attribute; and the seat of trouble referred to here is only one. There are a number of others.

What Happened.

The multiform tariffs of electricity supply undertakings contain what are tantamount to contracts with consumers; and, if consumers so desired, they could decline to pay increased charges without the present contracts being terminated within the conditions of the contracts. The question has been raised at a meeting of the Weymouth Town Council. There the Electricity Committee proposed that the prices for the supply of current should be advanced by 15 per cent. on lighting, including "fixed price" agreements, and 20 per cent. on heating, cooking, power, and contract supplies. The recommendation of the Committee was challenged by Mr. Freeman on the ground of illegality. He intimated that a number of people had resolved not to pay the additional charge of 15 per cent.; and he did not see how it was possible to charge on a fixed contract, especially as certain parts of the contracts were for fittings only, some of which had been paid for years ago. Defence of the Committee's proposal was essayed by Mr. England; and he made a statement with which it is impossible to agree. He asserted that "all contracts made before the war were broken," by which we understand him to mean cancelled through the war. We should be sorry to accept Mr. England as a safe judicial authority on the point; and some industries, and in fact the whole country, would have been plunged into a sad condition of disorganization if his view had been correct. We can, for instance, see electricity undertakings foregoing the benefit of fuel contracts made before the war. When, however, Mr. England based his appeal for the increased price on the ground of equity and justice, then we are in agreement with him. Few (if any) electricity undertakings can afford to sell current now at the same price as before the war, the unpremeditated conditions imposed by which enjoin us all not to bye-pass equity. The Weymouth Electricity Committee cannot boast of having come out of the contest with flying colours, as their recommendations were only carried by a majority of one.

Contracts and Increased Charges.

The other day we came across an instance of loose bargaining with a consumer by the representatives of an electricity concern. The consumer has no particular care whether he uses gas or electricity for the purposes of his trade. His business is conducted in a place where he has to have artificial lighting (though not much of it) during the daytime. In the summer his preference leans to electricity; in the winter to gas, because of the extra warmth in a room where there is no fireplace, and the gas-burners give him both light and heat. He then partially uses gas for lighting; gas is always employed for water heating; and for a small power purpose electrical energy is used. Altogether, the consumption of electricity is approximately 120 units per quarter. When he first started using current, the charge was 5d. for lighting and 2d. for power, with 2s. 6d. meter-rent per quarter for each meter. His first objection was to the payment of rent for the second meter; and he threatened to have the electric lighting cut off, and to return entirely to gas. The result was an offer by the electricity suppliers to serve him with current at a uniform price of 3d. all round. Formerly his account had amounted to about £1 5s. for lighting, and 10s. for power, *plus* 5s. for the rental of the two meters—about £2 in all. At the

Loose Charge Arrangements.

uniform 3d. rate, the account totalled to about 30s., *plus* 2s. 6d. meter-rent. Before the beginning of the current quarter, notice was given that it would be necessary to revert to the 5d. per unit for lighting and 2d. for power. He again objected; and the proposal was then made that he should be charged at the rate of 80 units for lighting, and 40 units for power, assuming the registered consumption by the one meter was 120 units per quarter. This would have meant £1 13s. 4d. for lighting, 6s. 8d. for power, *plus* 2s. 6d. for meter-rent. He pointed to his still existing gas-fittings; and a compromise was effected whereby half the consumption through the one meter is charged at the lighting rate, and half at the power rate. This is business as conducted electrically. The electricity suppliers could not charge at a higher rate for the power supply than is charged to other persons in the same line of business; but what would be the legal position if the men in that line of business are not being charged on similar terms, and this man is getting a preference simply because he is unsubmissive, and has his gas-fittings ready for use?

Hire and Maintenance of Motors.

Recently there was under discussion, at sectional meetings of the Institution of Electrical Engineers, a paper by Mr. Henry Joseph, of Hawick, on the "Hire and Maintenance of Continuous Current Motors." The rates of hire which cover maintenance appear to be fairly steep; and there is unanimity of opinion among electrical engineers that high inclusive rates are an imperative necessity. At Hawick, the total number of motors fixed is 276; the aggregate horse power 2054; and the average 7·5—the highest connected being 250. Sample rates of hire are:

H.P.	Quarterly Rental. £ s. d.	H.P.	Quarterly Rental. £ s. d.
¼	0 9 0	10	3 5 0
1	1 0 0	20	4 5 0
5	2 5 0	50	6 5 0

The hire rate includes the motor complete with pulley, starter, main switch, cut-outs, shunt regulator, and slide rails (if required), all fixed and connected up. The hirer pays for belting and the cost of mains from the service (or from the nearest available point of supply) to the motor and starter. The rental covers the cost of maintenance and renewals. New brushes are fitted when required; and no question as to whether the Company are liable ever arises in the event of a breakdown. Damage occasionally occurs as the result of carelessness or negligence on the part of the hirer's employees; but Mr. Joseph says it has not been considered good policy to raise the question of liability in such cases. To this policy, coupled with prompt attention to repairs, the success of the hire system of motors is said to be largely due. The Company safeguard themselves against loss due to a motor being hired for a short period and then returned, by inserting a clause in the hire agreement by which the hirer undertakes to pay an agreed sum to cover the cost of installation and removal in the event of the motor being returned before the expiration of a stated period. Since 1902 the average horse power, Mr. Joseph states, has increased from 3·2 to 6·1; and the capital cost has diminished from £14 to £6 per horse power. There has been a gradual increase in the percentage cost of maintenance due to the ageing of the bulk of the motors; and this figure, he thinks, will probably settle down to an average of about 6 per cent. on capital cost. During the last five years, the gross rentals amounted to about 18 per cent. of the capital outlay (about 25 per cent. is the average rental obtained on the total cost with new motors during this period), and the net rental was about 12 per cent., part of which is allocated to revenue and the balance set aside to a redemption fund for writing-down to the value of the motors when returned from hire. With regard to these percentages, at the meeting of the Leeds Section, Mr. T. Roles, of Bradford, gave it as his opinion that the annual charge for hire should not be less than 15 per cent. on the total cost of the motor, slide rails, and starter, seeing that the rental has to cover repairs, maintenance, inspection, interest, and depreciation; further that, based on a fifteen years' life, from 8 to 9 per cent. of the total cost would be required annually for interest and depreciation alone. In his case, since 1906, hired motors have been depreciated yearly on the basis of 6 per cent. of their prime cost. Mr. W. B. Woodhouse, of Dewsbury, is of opinion that, to make one charge cover all services, 20 per cent. is a reasonable figure.

German Aniline Dye Combine.—"The Times" of yesterday says: The German aniline dye companies published their reports last week, and at the same time announced another important step towards the syndication of practically the whole industry. There are at present two main groups—on the one hand, the Baden Aniline and Soda Company, the Bayer Company, and the Berlin Manufacturing Company; and, on the other, the works at Höchst and the concerns of Cassella and Co. and Kalle and Co. These six concerns have now been joined by the Weilerter Meer Company, and the seven concerns, which between them have a capital of over £11,000,000, have formed a new "community of interests." It is asserted that the companies will retain their independence, but that they will in future share their "experience," and all products will be manufactured by at least two of them simultaneously. The combination is admittedly intended to meet foreign, and especially British and American, competition.

GAS COMPANIES' POWERS IN QUEENSLAND.

A Government Measure.

In our issue of Feb. 1 [p. 271] reference was made to a Bill introduced in the Legislative Assembly at Brisbane having for its object the regulation of the whole of the gas companies and other authorities supplying gas in Queensland. We have now before us a text of the Bill as introduced; and, although no definite information is to hand that it has become an Act, there is every reason to believe that this is so. In any case, the novel details of the project will be of interest to our readers.

It is entitled: "A Bill to prescribe standards of illuminating power, heating power, purity, and pressure for gas, and to regulate the price thereof, to regulate companies and others supplying gas, and for purposes consequent thereon or incidental thereto." We intend to reproduce the text of the Bill practically *in extenso*, as, if the clauses are examined they will be found to contain provisions which are worth some little comment. The following notes are numbered with reference to the numbers of the clauses themselves.

SHORT TITLE.

1.—This Act may be cited as the "Gas Act of 1915," and shall come into operation on Jan. 1, 1916.

OPERATION OF ACT.

2.—This Act shall have effect notwithstanding anything to the contrary, whether express or implied, in any Act, rule, or regulation, or in any contract or agreement, whether oral or written, or in any deed, document, security, or other writing whatsoever; and nothing contained in any of the aforesaid matters or things shall be construed to prejudice or affect the full and effectual operation of this Act.

2.—The stringency of the clause dealing with the operation of the Act, which sweeps away without any consideration previous Acts or contracts, is (to our conservative minds) a little startling. The Bill deals with, among other things, alteration in price and alteration in profits. When amendments are made in Local Acts in this country, we need hardly point out that both the debit and credit side of the accounts are taken into consideration before a new price is fixed, and a new rate of dividend authorized.

DEFINITIONS.

3.—In this Act, unless the context otherwise requires, the following terms have the meanings set against them respectively:

"Gas company" or "company."—Any company, corporation, firm, or person supplying any gas for lighting, heating, motive power, or other purpose, and disposing of the same for profit. The term includes a local authority.

"Local authority."—A local authority constituted under the "Local Authorities Acts, 1902-13."

"Minister."—The Secretary for Public Works or other Minister of the Crown charged for the time being with the administration of this Act.

"Prescribed."—Prescribed by this Act.

"Regulations."—Regulations made under this Act.

"This Act."—This Act and any proclamation or regulations made hereunder.

3.—The definition of gas company includes any body supplying gas for profit, which makes the net of the Act sweep very wide indeed. One would have expected it to be confined to any company, corporation, firm, or person established for the purpose of supplying gas, or whose main business is to supply gas.

APPLICATION OF ACT.

4.—This Act applies to all the gas companies which at the commencement of this Act supply gas or may at any time thereafter supply gas.

ILLUMINATING POWER, HEATING POWER, AND PURITY AND PRESSURE OF GAS.

5.—(1) The quality of the gas supplied by a company shall, with respect to its illuminating power, its heating power, and its purity, be as prescribed in the first schedule to this Act. Unless a company is prevented by accident or by the necessity of temporarily opening or otherwise temporarily disturbing its mains in the locality, for the purpose of effecting repairs to or making connections with such mains, all gas supplied by a company to any consumer of gas shall be supplied at such pressure as is prescribed in the first schedule to this Act.

(2) The apparatus to be used for testing gas shall be as prescribed in the second schedule to this Act. The method of testing shall be as prescribed by the regulations.

(3) A company shall provide testing-places at places approved by the Minister. Such testing-places shall not, except by agreement between the Minister and the company, exceed three in number. The company shall provide all the apparatus required by this Act for the testing of its gas, and shall at all times, if so required by the Minister, keep such testing-places and apparatus in proper order and repair.

(4) Any gas examiner may, at a testing-place, or at any public lamp, or at the inlet of any meter, as and when he thinks fit, test the pressure at which the gas is supplied.

5.—This prescribes a standard of illuminating power and heating power in addition to purity and pressure. In view of our own legislation and legislation in Canada, the establishment of a dual standard of quality—namely, illuminating as well as heating power—strikes us as being distinctly retrograde, more particularly

when penalties are prescribed for defects in either quality. By sub-section 1 it will be noted that the pressure must be as prescribed, unless the company is prevented for certain reasons from maintaining the pressure. No reference is made to section 7 sub-section 6, whereby causes other than those mentioned may be reasons why no penalty may be incurred. The consequence of the contradiction between section 5 sub-section 1 and section 7 sub-section 6 appears to us to open the way to much undesirable uncertainty. By sub-section 2, the apparatus is to be as prescribed in the second schedule to the Act. It should be noted that the second schedule contains no reference to apparatus for testing the heating power. There is in sub-section 3 a limitation to three of the number of testing-places installed by agreement.

APPOINTMENT OF EXAMINERS AND TESTING BY THEM.

6.—(1) The Governor in Council may from time to time appoint fit persons to be gas examiners. Such examiners may, at any reasonable hours, and subject to any reasonable oversight, test the illuminating power, heating power, purity, and pressure of the gas supplied by any company, and for that purpose may enter any land or premises of such company. All such tests shall be made in accordance with this Act.

(2) A gas examiner shall, on the day immediately following that on which the testing has been conducted, make and deliver a report (to be filed in the office of the Minister) of the results of his testing, and deliver a copy of such report to the gas company.

(3) Every company and its officers and servants shall give to a gas examiner and to his assistants access to the testing-place, and shall afford all facilities for the proper execution of this Act. If any company or any such officer or servant fails to comply with this section, it or he shall be liable to a penalty not exceeding £10.

6.—It must be observed that the gas examiners may test the gas at any reasonable time, and may enter any land or premises of the company. Sub-section 3, however, only requires the officers to give the gas examiner access to the testing-place and afford facilities for the proper execution of the Act. It is not quite clear why access is necessary to any land or premises of the company; and it must also be pointed out that, although the Governor in Council is not given power to appoint assistants to gas examiners, or to allow such assistants to make tests, yet by sub-section 3 the gas company must give access to such assistants.

DEFECTS AND PENALTIES.

7.—(1) If on any day the gas supplied by any company at any testing-place is of less illuminating power than is prescribed, the company shall be liable to penalties as follows: If the deficiency does not exceed one candle power, a sum not exceeding £2. For a deficiency in excess of one candle power, a sum equivalent to £25 for each candle power of such deficiency.

(2) If on any day the heating power of the gas supplied by any company at any testing-place is of less heating power than is prescribed, the company shall be liable to penalties as follows: If the deficiency does not exceed 14 British thermal units, a sum not exceeding £2; if the deficiency exceeds 14 British thermal units, but does not amount to 28 British thermal units, a sum not exceeding £5; for each complete 28 British thermal units, a sum not exceeding £10.

(3) If on any day the gas supplied by any company at any testing-place is of less purity than is prescribed, the company shall be liable to a penalty not exceeding £50 for each occasion on which it is so in default.

(4) Provided that: (*a*) Where one penalty is imposed in respect of defective illuminating power, defective heating power, or excess of impurity in the gas supplied by the company at one testing-place on any day, no further penalty shall be imposed in respect of the same offence discovered at any other testing-place of the company on the same day; (*b*) the average of any three testings made on any three days within any period of six months shall be deemed to represent the illuminating power or heating power of such gas on the third day at such testing-place.

(5) If at any time the gas supplied by any company is supplied at a pressure less than is prescribed, the company shall be liable to a penalty not exceeding £10. Provided that, where a penalty is imposed in respect of insufficiency of pressure in the gas supplied by the company during any period of twenty-four hours, no further penalty shall be imposed in respect of insufficiency of pressure in the gas supplied by the company during the same period.

(6) No penalty shall be incurred by a company for defect of illuminating power, or heating power, or excess of impurity, or insufficiency of pressure, in the gas supplied by the company, in any case in respect of which it is proved that such defect or excess or insufficiency was produced by any circumstance beyond the control of the company.

7.—The company, it will be observed, is liable on one and the same day to a penalty for deficiency in candle power and for deficiency in illuminating power, as well as for a defect in purity or in pressure; but they are saved from further penalties for the same offence at other testing-places on the same day.

Attention should also be drawn to paragraph (*b*) in sub-section 4, wherein it is stated that the average of any three testings made on any three days within any period of six months shall be deemed to represent the illuminating power or heating power of such gas on the third day at such testing-place. While, therefore, the dual provisions would appear to be exceedingly stringent, and as we would suggest not a little unfair, this last clause might easily reduce the whole matter of regulating quality by testing to a farcical absurdity.

Sub-section 6, *re* saving as to penalties, has already been referred to, and should be compared to the English "Model Clause," which, in addition, prevents a company from pleading want of funds as an excuse for a deficiency.

GAS REFEREES AND THEIR POWERS.

8.—(1) The Governor in Council may from time to time appoint a fit person or persons to be a gas referee or gas referees for the purposes of this Act.

(2) A gas referee shall, for the purpose of any reference under this Act, have all the powers of a Judge of the Supreme Court on the hearing of an action in that Court—including the power to grant costs; and, in addition, the gas referee shall have the power, of his own motion, to summon and examine witnesses, and to call for and enforce the production of all such books, accounts, contracts, vouchers, documents, and writings as in his opinion will or may assist him in the matter of the reference.

(3) Upon any such reference, the Minister and the company concerned, and any consumers requiring the reference, shall be entitled to be represented and be heard.

(4) Every such reference shall be heard and determined in open court.

DEFRAYING COST OF SERVICE PIPES.

9.—(1) A gas company shall, upon being required so to do by the owner or occupier of any premises situated within 50 yards from any main of such company, give and continue to give a supply of gas for such premises, and furnish and lay any pipe that may be necessary for such purpose: Provided that the cost of so much of any pipe for the supply of gas to any owner or occupier as is laid upon the property of such owner or in the possession of such occupier, and of so much of any such pipe as is laid for a greater distance than 66 feet from any pipe of the company, although not on such property, shall be defrayed by such owner or occupier.

(2) Every owner or occupier of premises requiring a supply of gas by meter shall serve a notice upon the company at the office, specifying the premises in respect of which such supply is required, and the day upon which the supply is required to commence—not being earlier than thirty days where gas has not previously been supplied to the premises, or seven days where gas has previously been so supplied. Whenever the company wilfully neglects or refuses to give a supply of gas to any owner or occupier of premises entitled to the same under such pressure as is prescribed, it shall be liable to a penalty not exceeding 40s. for each day during which such default continues.

9.—The power of the consumer to demand a supply should be compared with section 11 of the "Gas-Works Clauses Act, 1871." It will be observed that the clause does not give any security to the company as to the continuity of the supply or as to a guarantee that the rent payable should provide a reasonable return upon the outlay to which the company has been put in furnishing the supply.

COMPANY MAY BE ORDERED TO SUPPLY GAS.

10.—Any twenty occupiers or owners of premises situated in a defined locality within the limits wherein which a company is authorized to supply gas may address a memorial in the prescribed form to the Minister, setting forth that the premises are not supplied with gas, and could conveniently be so supplied, and ought reasonably to be so supplied by such company, and undertaking to become consumers of gas upon its being so supplied. Thereupon the Minister may refer such memorial to a gas referee appointed under this Act; and such gas referee shall hear and determine the matter accordingly. If the gas referee determines that the memorial shall be given effect to, whether in whole or in part, he shall order the company, within a time to be fixed by him, to lay such mains and pipes, and to do all such other works and things as are required for the purpose of supplying gas to the premises within a locality to be defined by him, and the company shall obey such order. If within such time fixed the company has not conformed to such order, the Minister may conform to the same, and for such purpose shall be deemed to be the irrevocable attorney and agent of the company; and all expenses incurred by the Minister in so doing shall be repaid to him by the company. A certificate under the hand of the Minister certifying the amount of such expenses may be filed in the office of the Registrar of the Supreme Court, and shall be deemed to be a judgment of the Court, and be enforceable against the company accordingly.

10.—By this clause any twenty occupiers can demand a supply, and the matter may be referred by the Minister to a gas referee. But here, again, no provision is made that the gas referee, when making his order that the company shall give the supply, shall also frame his order in such a way as to ensure that the giving of such supply does not entail a loss to the company.

TESTING OF METERS.

11.—No meter shall be issued for the use of a consumer by a company until it has been first tested and stamped by a gas examiner in accordance with the regulations. Within twelve months after the commencement of this Act, every meter in use on the premises of any consumer at the commencement of this Act shall be so tested, and, if found accurate, stamped. All meters issued by a company, and in use, shall be again tested, and, if found accurate, restamped at intervals of not more than seven years. All meters which, after testing, are found to be inaccurate shall be removed at the expense of the company.

11.—This clause deals with the testing of meters, and it is worth while noting that all meters must be restamped at intervals not exceeding seven years. Nothing is said as to adjustment of accounts if defects are found in the meter, which would have caused its registration to be incorrect either in favour of the consumer or of the company; nor is any power given to a consumer to obtain the re-test of a meter which is "suspect."

PRICE OF GAS.

12.—Subject to this Act, and notwithstanding anything contained in any Act or any Memorandum or Articles of Association, the price to be charged by a company for gas supplied by it to consumers by meter shall be at the rate following per 1000 cubic feet—that is to say: (*i*) By the Brisbane Gas Company at the rate of 4s.; (*ii*) By the South Brisbane Gas and Light Company, Limited, at the rate of 4s. 6d.; (*iii*) By any other gas company at the rate charged by such company on Nov. 1, 1915, until the rate has been fixed in the manner hereinafter provided, and thereafter at that rate.

FIXING PRICE OF GAS FROM TIME TO TIME.

13.—In order to ensure that the price of gas payable by consumers shall be fair and reasonable to the consumers and to the company supplying the same, the following provisions shall be in force:

(*i*) The Minister of his own motion, or any company or fifty consumers of gas, may, by application to the Minister, require that the question of the price of gas payable by consumers to a company shall be referred to a gas referee for hearing and determination, and the same shall be referred accordingly.

(*ii*) The Minister, or the Brisbane Gas Company, or the South Brisbane Gas Company, or any fifty consumers of gas supplied by either of such companies, may, at any time after the commencement of this Act, require such reference to be made as last hereinbefore mentioned with respect to the price of gas herein prescribed as chargeable by such companies respectively.

(*iii*) The Minister shall, within six months after the commencement of this Act, require such reference to be made with respect to the price of gas to be chargeable by any gas company other than the companies mentioned in paragraph (*iii*) of clause 12.

(*iv*) Forthwith upon any such reference being made, such gas referee shall proceed to hear and determine the matter of the reference, and shall accordingly fix the price of gas to be thereafter chargeable to consumers by the company concerned.

(*v*) When the price of gas has been finally fixed, upon a reference in accordance with this section, that price shall remain unaltered for a period of two years, and thereafter unless or until the price is again fixed by a further reference as herein provided, and so on from time to time.

(*vi*) If the Minister or any party to the reference is dissatisfied with the price determined by the gas referee, he shall have the right to appeal to a judge of the Court of Industrial Arbitration; and such judge shall thereupon have jurisdiction to hear and determine such appeal, and his decision shall be final and without appeal. Such appeal to such judge shall be by way of rehearing. Upon such appeal such judge shall have all the powers and authorities vested in him as a Court under the "Industrial Arbitration Act of 1915."

(*vii*) For the purposes of determining the price of gas, the gas referee, or on appeal such judge, shall be guided by the directions set forth in the third schedule to this Act or any amendment of such schedule in force for the time being.

12 and 13.—These sections deal with the price of gas, which it will be observed is definitely fixed subject to reconsideration. In accordance with section 13, it should be noted that by sub-section 5, when once the price of gas has been reconsidered and fixed, it cannot be altered for two years; and seeing that by schedule 3 the price chargeable for gas is to be ascertained by adding together the cost of production and the return on the invested capital (7½ per cent. on same), it would appear that schedule 3 of the Act fixes a price which may not coincide with the price fixed by section 13. Our comment on the arrangements for limiting profits and fixing price is that they appear to compare very unfavourably, from both the consumers' and the companies' points of view, with the sliding-scale and other standard financial clauses with which we are so familiar here.

PRICE CHARGEABLE FOR PREPAYMENT METER SUPPLY.

14.—(1) A company may demand for gas supplied through a prepayment meter a not greater charge than for gas supplied by it to consumers through any other kind of meter or by any other method of supply.

(2) The charge for the hire of any prepayment meter and fittings to be used therewith, or of any prepayment meter without fittings, shall in either case be a sum of money calculated according to the quantity of gas supplied through the prepayment meter, and the maximum charge shall in either case be at the rate to be prescribed by the regulations.

(3) The charges shall include the providing, letting, fixing, repairing, and maintenance of the meters and fittings of the meters (as the case may be), and the cost of collection and other costs incurred by the company in connection therewith.

(4) For the purposes of this section, the expression "prepayment meter" means any meter or appliance by which the quantity of gas supplied is regulated according to the amount of money prepaid therefor.

ANNUAL STATEMENT OF ACCOUNTS.

15.—Every gas company shall cause to be filled up and forwarded to the Minister, on or before the 31st of March in each year, an annual statement of accounts, made up to Dec. 31 then next preceding, in the form and containing the particulars specified in the regulations. The company shall keep copies of such annual statement at its office, and sell the same to any applicant at a price not exceeding 1s. for each copy. A gas company operating in any enterprise other than gas-making or gas-works situated in separate districts of the State, or operating outside of as well as within the State, shall (if so required by the Minister) furnish separate accounts in the form prescribed in respect of each and all of its enterprises or gas-works, or places of business in Queensland. If any such company makes default in complying with this section, it shall be liable to a penalty not exceeding £2 for each day during which such default continues.

EXAMINATION OF ACCOUNTS.

16.—(1) The Auditor-General, at the request of the Minister, shall, and the Minister may on his own initiative, or at the request of not less than twelve users of the gas of any company, cause the Auditor-General to examine and audit, or cause any officer of the public service appointed by the Minister in that behalf to examine and audit the accounts of such company, and for the purposes of such audit examine any books and documents relating to such accounts.

(2) If any person obstructs the Auditor-General, or any officer so appointed, in the exercise of his powers or the performance of his duties under this section, or without lawful excuse refuses to produce any book, account, document, writing, paper, or instrument in his possession or under his control, or to answer any question asked by the Auditor-General or such officer for the purpose of the exercise of such powers or performance of such duties, he shall be liable to a penalty not exceeding £20; and if any person, after conviction for any such offence, still refuses to produce any such book, account, document, writing, paper, or instrument, or to answer any such question, he shall be liable to a further penalty not exceeding £20 for every day during which such default continues.

RETURNS MAY BE CALLED FOR.

17.—Returns for the purposes of this Act may be required to be made by any company or any person at any time, in any form, and verified in any manner required by notice given by the Minister for that purpose. The Minister may require from any company or any person at any time any further or fuller returns than the returns made by such company or person. If any company or person makes default in transmitting to the Minister any return required by this Act, or makes a false declaration in verification of any such return, such company or person shall be liable to a penalty not exceeding £100. Any return furnished pursuant to this section shall be treated as confidential, and shall not be disclosed except to a gas referee or judge of the Court of Industrial Arbitration for the purposes of this Act.

SCHEDULES AND THEIR AMENDMENTS.

18.—Any schedule of this Act may from time to time be amended or added to, or a new schedule in lieu thereof substituted, by the Governor in Council by Order in Council published in the "Gazette." Any schedule so amended or added to, or any such new schedule, shall thereupon be a schedule to this Act: Provided that three months' notice shall be given in the "Gazette" of the intention of the Governor in Council to exercise his powers under this section: Provided further that, if any company affected by any amendment of the first or second schedule signifies its disapproval of such amendment by notice in writing to the Minister within 14 days after the publication in the "Gazette" of such amendment, the same shall not take effect unless or until a judge of the Court of Industrial Arbitration has held a public inquiry and allowed such amendment. Due notice shall be given of the holding of such inquiry to the Minister and to every company affected, which may be represented thereat.

REGULATIONS MAY BE FRAMED.

19.—The Governor in Council may from time to time make regulations providing for all or any purposes, whether general or to meet particular cases, that may be convenient for the administration of this Act, or that may be necessary or expedient to carry out the objects and purposes of this Act; and, where there may be in this Act no provision or not sufficient provision in respect of any matter or thing necessary or expedient to give effect to this Act, providing for and supplying such omission or insufficiency. And, without limiting the generality of the foregoing provisions by such regulations, provision may be made for the testing, stamping, and examination of meters, the registration and regulation of meters, and any matters incidental thereto. Such regulations may provide a penalty not exceeding £50 for any contravention thereof. All such regulations shall be published in the "Gazette," and shall thereupon have the same force and effect as if they were embodied in, and formed part of, this Act. Such regulations shall be laid before Parliament within three weeks after such publication if Parliament is then sitting, and, if not, then within three weeks after the beginning of the next session of Parliament. If the Legislative Assembly passes a resolution disallowing any such regulation, of which resolution notice has been given at any time within thirty sitting days of the House after such regulation has been laid before it, such regulation shall thereupon cease to have effect, but without prejudice to the validity of anything done in the meantime.

18 and 19.—It should be noted that by these sections power is given to vary the schedules or regulations made under the Act; but in the latter case the approval of Parliament is necessary.

PROCEDURE AND PENALTIES.

20.—(1) All proceedings in respect of offences against this Act may be heard and determined in a summary way under the "Justices Acts, 1886 to 1909."

(2) Any person who acts in violation of this Act shall, unless for such offence a penalty is expressly provided, be liable to a penalty not exceeding £50.

As to the schedules.

Schedule 1 deals with quality, and prescribes 15-candle gas of 540 B.Th.U. total heat value, without any sulphuretted hydrogen, not more than 4 grains of ammonia per 100 cubic feet, and a pressure of 15-10ths. We have already remarked on the inexpediency of a double standard of illuminating and heating power; and in any case the prescription of a 15-candle light standard for a gas of 540 B.Th.U. may lead to difficulties in manufacture.

Schedule 2 deals with the apparatus. The first comment is that

it revives the obsolete Evans photometer as one of the possible alternative photometers, although the standard of light is to be the Harcourt two-candle (*sic*) pentane lamp. If a 10-candle lamp is meant, we think the experience of photometrists is that it is not practical to use a 10-candle pentane standard in an Evans' photometer. No provision is made for apparatus for correcting the value of gas to N.T.P.; and the gas companies may, with the consent of the Minister, use a jet photometer for ascertaining the illuminating power!

No apparatus is prescribed for testing the heating power; and it would, therefore, appear that it will be necessary for the schedule to be amended at once; otherwise there is no power in the Act, as it is drafted, to order tests for heating power. [See section 5 sub-section 2.]

The apparatus for testing for ammonia calls for one comment —viz., glass beads are usually employed and not glass marbles. The prescription of the apparatus for testing pressure is somewhat extraordinary, because what is prescribed is a recording pressure gauge which is to be connected to the lamp cock. If this is compared with section 5 sub-section 4 and schedule 1, it is difficult to see how these provisions can be reconciled with schedule 2; and it must be noted that, although regulations as to method of testing can be made, the apparatus to be used shall be as prescribed in the second schedule.

Schedule 3 deals with the cost of gas, and the price chargeable. It will be observed that certain particulars are to be set out for ascertaining the cost of production. Further than this, certain particulars of the money invested in the business must also be set out, to which an addition of 7½ per cent. may be made. The schedule then goes on to show how the price chargeable shall be ascertained; and it would appear to be difficult to reconcile this schedule with section 12, which definitely fixes the price of the gas. Either the price is to be fixed by the Act or it is to be fixed by the method detailed in the schedule. We could have understood the object of the schedule if section 12 had said that the price to be charged by any company for gas shall be that ascertained to be chargeable by the means that are set out in schedule 3. [See sub-section *vii.* of section 13.] We have already commented on the further inconsistency as to the price being unaltered for two years after it has been fixed.

These comments are made, of course, from the point of view of English experience; and we shall be interested to see if any changes are made in the Bill during its passage through the Legislative Assembly, and before it receives the Royal Assent.

Schedule I.—Standards.

(A) *Of Illuminating Power.*

The quality of gas shall, with respect to its illuminating power, be such as to produce, at a testing-place provided in conformity with this Act, when burned at the rate of 5 cubic feet per hour, a light equal in intensity to the light produced by 15 sperm candles of six to the pound, each consuming 120 grains of sperm per hour.

(B) *Of Heating Power.*

The quality of gas with respect to its heating value shall be not less than 540 British thermal units total heating value.

(C) *Of Purity.*

Gas shall, when tested in accordance with this Act, contain:
No hydrogen sulphide.
Ammonia—Not more than 4 grains per 100 cubic feet.

(D) *Of Pressure.*

Gas shall be supplied at such pressure as to balance a column of water not less than 15·10ths of an inch in height at the main or as near as may be to the junction therewith of the service pipe supplying the consumer.

Schedule II.—Testing of Gas.

1.—The apparatus for testing the illuminating power of the gas shall consist of the improved form of Bunsen photometer, known as Letheby's open 60-inch photometer, or Evans's enclosed 100-inch photometer, together with a proper meter, minute clock, governor, pressure gauge, and balance, or the Harcourt table photometer. The burner to be used for testing the gas shall be the "Metropolitan" argand burner No. 2. The standard of light shall be the Harcourt two-candle pentane lamp; and the pentane used therewith, and the methods of testing thereof, shall be such as are prescribed in the regulations. Provided that gas companies may, with the consent of the Minister, use Lowe's jet photometer for ascertaining the illuminating power of the gas in standard candles.

2.—The apparatus for testing the presence in the gas of sulphuretted hydrogen shall be a glass vessel containing a strip of bibulous paper moistened with a solution of acetate of lead, containing 60 grains of crystallized acetate of lead dissolved in one fluid ounce of water.

3.—The apparatus for testing the presence of ammonia shall consist of a glass vessel filled with glass marbles moistened with standard sulphuric acid; and the test shall be carried out so as to show the total amount of ammonia contained in the gas.

4.—For the purpose of the test of pressure, the examiner shall connect a recording pressure gauge to the lamp-cock by a flexible or other suitable pipe, which shall be gas-tight; and such pressure-gauge shall be as nearly as practicable at the same level as the lamp-cock.

Schedule III.—Directions to be Observed in Determining the Price of Gas.

1.—The cost of production of gas per 1000 cubic feet of the company concerned shall be ascertained in accordance with the following formula:

Particulars for Ascertaining the Cost of Production of Gas.

—	Cost.	Cost per 1000 Cubic Feet.
	£ s. d.	£ s. d.
1. Coal, oil, &c., used		
2. Purifying materials, water, and sundries		
3. Office management—		
(*a*) Directors' fees		
(*b*) Salary of manager		
(*c*) Clerical staff		
(*d*) Rent actually paid		
(*e*) Other expenses		
4. Salaries of engineers and other officers at works		
5. Wages paid under "Industrial Arbitration Act"		
6. Other wages		
7. Repairs and maintenance of works and plant—		
(*a*) Materials		
(*b*) Wages paid under "Industrial Arbitration Act"		
(*c*) Other wages		
(*d*) Other charges		
8. Distribution (not included under office management above)—		
Salaries and wages of officers—		
(*a*) Wages paid under "Industrial Arbitration Act"		
(*b*) Other wages and salaries		
9. Repair, maintenance, and renewal of mains and service pipes—		
(*a*) Materials		
(*b*) Wages paid under "Industrial Arbitration Act"		
(*c*) Other wages		
	£	£
Deduct proportional cost of labour entailed in production of residuals	£	£
Total cost of production of all gas	£	£

The amount of total cost of production of all gas shall be divided by the total amount of gas made as per station meter; and the result will be the ascertained cost of production per 1000 cubic feet.

2.—The actual amount of money invested in the gas undertaking of the company concerned shall be ascertained in accordance with the following formula:

Particulars for Ascertaining the Actual Amount of Money Invested in the Gas Undertaking.

Items.	Present Value.
	£ s. d.
1. Land occupied by the company and used in its business	
2. Buildings occupied by the company and used in its business	
3. Furniture and office requisites	
4. Gas meters	
5. Machinery (engines, &c.)	
6. Plant other than machinery	
7. Mains, pipes, and fittings	
8. Other equipment	
9. Reserves—	
Coal	
Pipes	
Fittings	
Total	£
7½ per cent. on total	£

A sum equal to £7 10s. per cent. of the total amount so ascertained shall be divided by the total amount of gas made, as per station meter; and the result will be the ascertained return per 1000 cubic feet on the actual amount invested in the gas undertaking.

3.—The price chargeable per 1000 cubic feet of gas shall be ascertained as follows:—

—	Per 1000 Cubic Feet.
	s. d.
Add together—	
Ascertained cost of production	
Ascertained return on actual amount invested in the gas undertaking	
Price chargeable	

4.—In ascertaining the cost of production of gas, consideration shall be given to what is necessary for the efficient and economical management of the undertaking. Without limiting the powers and discretions of the gas referee or the judge on appeal, any payments to directors, officers, agents, or other persons, or by way of commission, rent, or other charge which are found to be unnecessary or excessive shall be disallowed or reduced to such amount as is deemed proper.

5.—In ascertaining the actual amount of money invested in the gas undertaking, no allowance whatever shall be made for goodwill. The several items shall be separately valued *in situ* as part of a going concern, after making due allowance for depreciation.

THE PAUCITY OF SCIENTIFIC RESEARCH.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

The current discussions as to our inferiority as a Nation in respect to research work, as compared with Germany, have directed the attention of many minds towards the causes and the remedy. We may take it that our own special industry is fairly representative of the position as regards Applied Science as a whole; and therefore a few considerations in connection with it are not without some bearing on the general question.

If such inferiority is in respect to quantity, we look round on the number of pages contained in, and the space occupied by, the 133 volumes of the "Journal of Gas Lighting," the 63 volumes recording the transactions of the Institution of Gas Engineers and its progenitors, the 30 books setting forth the proceedings of the affiliated District Associations, to say nothing about a considerable number of other communications that have gone outside the fold, and are to be met with in the reports of the Chemical Society, of the Society of Chemical Industry, the transactions of the leading Engineering Institutions, and the Society of Arts and Sciences. Having these in view, we speculate as to the probable dimensions of a library sufficient in area to contain a full and complete record of German gas research, and wonder if such can come within the means and facilities of an average engineer. If it is supposed that the deficiency is more a question of quality, there is no ground for the assumption that Germany or any other nation possesses facilities that are not equally available for ourselves; and such assumption confuses the original material with its practical applications. Our research work may in no sense be inferior; the default may rest with the methods of utilizing or applying the same.

The leading manufacturers of gas stoves and appliances in this country have for some time been running distinct laboratory and testing departments, under qualified control of a class that might even secure the approval of Professor Armstrong, seeing that these firms are not gas engineers as ordinarily understood. That they conduct a considerable amount of research, is shown by the communications they are good enough to publish from time to time. If these firms are capable of running departments of this character, and find it to their advantage to do so, why should not the makers of gas be equally interested in efforts of a similar character—individually so far as the larger undertakings are concerned, and collectively on the part of those working on a scale that does not admit of the establishment of a works laboratory? We have recognize the fact that, with a few notable exceptions, the director of a gas company or the member of a local authority gas committee does not look with complacency upon laboratory or research work. He may not object to the testing of materials or products to meet the exigencies of the moment, but prefers to see the technical staff fully occupied on matters that ensure an immediate cash return. With the exceptions already mentioned, the general advantage and progress of the industry at large, or considerations of a patriotic nature, are beyond his horizon. The engineer and his technical staff are made to understand that, while there is no objection to innovations that will immediately improve the working results, there is no time for work outside these limits; and many for this reason have a leaning towards the "intelligent stoker" element in preference to the more advanced or refined science student.

The consequence is that research work is left to those who are in a position to follow it as a hobby, or as a sort of spare-time recreation for the practical man whose tastes and turn of mind happen to be that way inclined. There are many disadvantages inseparable from independent individual work, which have tended to cast discredit upon the value of research—such as overlapping and repetition, the dwarfing or limitation due to personal or local environment, or lack of suitable apparatus and room, no systematic plan of record, sudden cessation of work perhaps at an important stage, on account of personal happenings or attention being drawn off by matters of immediate importance, when there is danger that the whole of the previous work may be overlooked or forgotten. The efforts may be misdirected, erratic, or in other ways of no value as a permanent record. Following the lines of individual idiosyncrasy, they may be wanting as regards a definite object, and may lead to nowhere. The records of patents that are published week by week afford some evidence as to the trend of research; and one cannot but be amazed at the technical ignorance that is occasionally evident in some of the specifications respecting the subject that the inventor aims to improve, and by the small proportion of so-called inventions that passes beyond the paper stage. This seems to indicate the existence of an immense amount of ill-directed, misplaced, or wasted energy that withers away and is lost, so far as practical results or general progress are concerned. There is a large amount of branch and leaf, but very little fruit or flower. Research should be directed towards one definite object, under competent and intelligent control that will keep the operator on a straight and away from a devious path; and the worker should have a clear idea as to the end in view. The highway of research is surrounded with will-o'-the wisps that tend to draw off attention towards some unimportant side issues.

If a certain industry or manufacture, such as that of gas appliances as above instanced, is confined to a comparatively few firms, possibly an important waste due to overlapping and repetition may not obtain; but each individual firm observes a degree of secrecy, and naturally regards results obtained as its own private property. Even if willing to publish information for the public benefit, they cannot be expected to take the risk of possibly benefiting a rival competitor in trade at their own expense. The makers of gas are in a different position to merchants, who have the world for their market, as each undertaking has its own pitch, and no direct interest in the terms on which its neighbours do business. One of the objects set forth in the memorandum of the Institution of Gas Engineers and similar Associations is the publication of information that comes under the head of more or less digested scientific research. But suppose that all of the larger gas undertakings in the country (say to the number of 200) established research departments under qualified control. There would be 200 laboratories and 200 distinct sets of workers, and, in the absence of some sort of general or central control, great wastage, due to duplication and overlapping; and the complete records, if they were ever published, would be so unwieldy as to be next to useless.

There is much to be said in favour of authoritative and competent central control, in preference to individual effort, either personal or on behalf of manufacturing firms. This opens up the wider question of whether research should be left to the technical organ or the representative society, or if it should be partially or entirely State-aided. That commercial enterprise in all stages, from initiatory experiments to the finding a market for the finished article, receives Government assistance in Germany is a matter of common knowledge; but the details are, of course, secret. When one hears about a particular chemical manufacturing firm running a staff of 200 chemists specially for the purposes of research, one would like full details as to whether the firm bears the whole expense, if the operations are under central control, what is the social status of the workers, and the terms of their remuneration—if by fixed inclusive salary, or by personal interest in the working results. There is also the connection between research as a national duty, as distinct from private interest. Up to about two years ago, there would be no doubt as to the answer. Questions outside personal interests did not enter into commercial considerations, and several notable examples of the continuance of these views in the face of pressing national obligations at the present time could be quoted. Among other special effects, war taxes the whole community for the benefit of a few who happen to be in the swim; and a suspicion that anything in the shape of research may lead to a similar result is one cause of the inadequate support accorded to the Institution research funds in the past. It has also altered the status of manufacturing industry. Gas undertakings are extracting benzol, not as a source of profit or an assistance in meeting increased expenses (for the operation has never been proved to be satisfactory as a commercial proposition), but in response to the request of a Government Committee. It would be interesting to know if analogous cases of manufacturing firms undertaking Government service at their own cost are in existence.

A Central Research Control Committee would soon realize the need for simplification of standards in respect to all details incidental to operations in frequent request. The confusion arising from the use of several different sizes of pipe threads and meter unions, special castings and fittings, standards of light, contract clauses, &c., has been recognized and dealt with by special Institution Committees. The student of research is greatly hindered by confusion of a similar character that applies to almost every branch of chemical investigation, sometimes to the extent of rendering results that otherwise would check each other absolutely incomparable. The respective enriching value of the several hydrocarbons known to be present in coal or other illuminating gas is a case in point. An enormous amount of research work on this subject may be found in the columns of the "Journal of Gas Lighting," spread over the whole period of its existence, from the first down to the current volume. But if we try to piece this together, and get at the average results, the first difficulty is the enormous difference in the results recorded by the various observers—all of good standing and presumably capable of accurate and reliable experimental work.

The values claimed for benzol cover a gamut represented by a ratio of no less than 1 : 5. There are not only different standards of weights and measures to contend with, but the indiscriminate use of terms of weight or measure, and considerable difference of opinion as to the number of cubic feet of vapour that correspond to a gallon of liquid, or other method of comparing or converting terms of weight into terms of capacity, or *vice versâ*. Continental workers use the metric or decimal system both as regards weights and measures; and the convenience in connection with experimental work is evident, in the absence of a calculating machine that deals with matters involving seven or eight digits in as many seconds. Much of the older English work is figured out in English weights and measures; and a comparison of these with the decimal system involves some mathematical ability. The reduction to standards in general use—such as grain, pound, gallon, cubic foot, &c.—is by no means a simple matter; it is not an easy thing to keep a clear head in respect to calculations involving conversion of grammes per cubic metre into grains per cubic foot. Then there is the practice of stating volumes of gases, without specific mention of the conditions. These may be dry or moist, at 60° and 30 inches, or at 760 mm. and 0° C.; and this also applies to calorimetric values and other properties. By means of a moderate amount of simplification on the lines above indicated, it would be possible to greatly

reduce the enormous labour incidental to mathematical calculations. In respect to boiling or melting points, flash points, &c., considerable differences may be brought about simply by detail of manipulation.

(To be continued.)

COMFORTS FOR WOMEN WORKERS.

Women are probably working now harder than they ever did before; and if they are to continue at this high pressure, it is essential that they should study their health and comfort in all ways that may be practicable. This thought arises out of a visit to Prince's Skating Club, Knightsbridge, where (under the patronage of Her Majesty Queen Alexandra) there is now open an exhibition representing an endeavour to furnish women with new ideas for getting a living. It would seem that to find now a fresh direction for women's activity would be a difficult task; but this is as may be. The exhibition contains many illustrations of what can be done, in the excellent examples of what has been done; and whether the ideas presented are new, matters not at all for the purpose of this note.

In some spheres, work is more laborious than in others; and there must be many women who return to their own homes at the end of the day with little spare energy to devote to unnecessary efforts in looking after themselves. Recognition of this fact is disclosed by the Women's Advisory Section of the Gas Light and Coke Company, who, in sympathy with their sex, have fitted-up in the exhibition a stand showing what are rightly described as "Comforts for the Bachelor Girl." A flat so equipped must be comfortable indeed; and there is nothing extravagant or difficult of attainment about it. The occupier arrives home, and the warmth of a fire is instantaneously available on the application of a match. The particular pattern of heater displayed on this occasion is the Davis "Adapta" gas-interior, in artistic finish, and with a suitable metal surround. Almost as rapidly, a hot bath is ready—the Parkinson "Hydrotherm," or automatic geyser, delivering hot water within a few seconds, and for as long as the tap remains open. The square pattern of this apparatus which is shown is specially designed for small houses and flats, where space is a consideration; and it will supply hot water to any taps that may be connected with it in any part of the premises. The gas-valve is opened when the tap is turned on, and the gas lit by a pilot. Similarly, with the closing of the tap the gas is automatically shut off, leaving only the pilot.

Then there is the meal to be prepared; and for this, of course, a gas-cooker is the very best thing obtainable. The one installed at the exhibition—and it is well suited to meet the requirements of the bachelor girl's flat—is that designed by Miss Helen Edden, the Principal of the Women's Advisory Staff. As an illustrated description of this cooker—which is manufactured by Messrs. Fletcher, Russell, and Co., Limited—appeared in the "Journal" as recently as Nov. 23 last [p. 429], the main features, which are that the oven is externally heated, and the hot-plate is provided with a closed-in top, need not again be referred to in detail. It may, however, be remarked that the model now shown is fitted with a special attachment in connection with which a patent has already been applied for. For this arrangement, an opening is made on each side at the bottom of the oven—over the two gas-burners, that is to say; and these inlets are provided with valves which are opened or closed by raising or depressing a lever on the outside of the oven. When quick heating-up is required, the valves can be opened; and the oven becomes an internally heated one. When the desired point is reached, the valves can be closed; and there is the sealed oven. In this form, therefore, the cooker can be heated at will either internally or externally. Showing the cooker in operation, Miss Edden explained that, with it, 7 cubic feet of gas in a quarter-of-an-hour will raise the temperature of the oven to 400°; and that an hour after the gas has been turned out, the temperature is 200°. Added to its various other qualities, the cooker is pleasing to the eye—which is an important point, if it is to be popular with bachelor girls.

To the gas-fittings on the stand are attached Telephos controllers with "Spitfire" igniters, which consist of two insulated tubes carrying a secondary supply of gas from the controller to a platinum wire coil in the igniter-tip. When the button is pressed and the circuit closed, a small flame is obtained, which lights the mantle. The display is in every respect a demonstration of modern methods for the utilizing of gas.

Recovery of Bye-Products from Blast-Furnaces.—At a meeting of the Glasgow Section of the Society of Chemical Industry on Tuesday last, Mr. Robert Hamilton read a paper in which he said that the first record of the presence of ammonia in blast-furnace gases seemed to be found in the report published in 1845 of the researches carried out by Bunsen and Playfair on the gases of a furnace at Alfreton. The first really practical attempt to recover bye-products from blast-furnace gases was made by Messrs. William Baird and Co. In 1879 experiments were begun at their iron-works; and the conclusion was soon arrived at that recovery on a practical scale was worth attempting. Many attempts were made to oxidize the ammonium sulphide liquors to sulphate; but these were not successful, owing chiefly to the fact that a considerable proportion of the ammonia was in combination with sulphuric acid—an acid requiring very strong oxidizing agents.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Meeting at Newcastle-on-Tyne.

The Annual Meeting of the Association was held last Saturday afternoon at the offices of the Newcastle and Gateshead Gas Company—the President (Mr. Thomas Waddom) in the chair. There was a large attendance.

Apologies for Absence.

Letters of apology for absence were read from, among others, Mr. A. E. Broadberry, the President-Elect of the Institution of Gas Engineers, Mr. Alexander Masterton, the President of the North British Association, and Mr. E. A. Harman, the President of the Manchester District Institution of Gas Engineers.

Votes of Condolence.

The President moved the following votes of condolence:

That this meeting records with deep regret the death of Mr. William Ford, who was one of the founders of the Association and filled the office of President during the year 1879 80, and again in the year 1908 9. He served upon the Committee for several additional periods, and was a frequent contributor to the proceedings and thereby rendered valuable help to the work of the Association.

That this meeting records with deep regret the death of Mr. William Scott, of West Hartlepool, who was a member of the Association for many years. Although he did not take an active part in the work of the Association he was a consistent and loyal supporter of its objects, and won for himself many sincere friends within its ranks.

The resolutions were agreed to; the members standing meanwhile.

Annual Accounts.

The President presented the statement of accounts, which, he said, bore favourable comparison, so far as the balance in hand was concerned, with the previous year. The expenses had been less, in consequence of the Association having cut-out their programme of hospitality in consequence of the war.

The statement was confirmed.

New Members and Associates.

The Hon. Secretary (Mr. Herbert Lees) next submitted the names of the following new candidates for membership of the Association:

Members: Mr. Thomas Hornby, Hessle; Mr. J. W. Precious, Haverton Hill-on-Tees; Mr. Thomas Spencer, Seaham Harbour; Mr. P. M. Watson, Cleveland; Mr. S. Shadbolt, Southbank and Normanby.

Associates: Mr. Alexander Massman, Gateshead; Mr. C. G. Barrett, West Hartlepool; Mr. F. J. Colman, Sunderland.

On the proposal of the President, the election of the candidates was confirmed.

Institution Benevolent Fund.

The President, in accordance with a recommendation of the Committee, moved:

"That a donation of £10 10s. be contributed to the Benevolent Fund of the Institution of Gas Engineers from the funds of the Association."

He pointed out that the amount was the same as voted last year, and double the sum they had been in the habit of giving. Seeing that the Association had a larger balance in hand this year than in the previous year, the Committee recommended that the contribution be again ten guineas.

Mr. Mark Fligg seconded; and the recommendation was agreed to.

Papers Read.

Mr. Geoffrey Weyman, M.Sc., of the Elswick Gas-Works, read a paper on "The Effect of War on Gas-Works Practice"—see pp. 273-6; and subsequently Mr. Herbert Lees, of Hexham, read one on "The Special Purposes Section"—see pp. 276-8.

Vote of Thanks to the Authors of Papers.

On the proposal of Mr. E. G. Hutchinson, seconded by Mr. T. M. Waller, a hearty vote of thanks was accorded to the authors of the papers.

Office Bearers.

The President presented the Scrutineers' report on the election of officers as follows:

President: Mr. Mark Fligg, Redcar.
Vice-President: Mr. Richard Nelson.
Hon. Secretary and Treasurer: Mr. Herbert Lees.
New Members of Committee: Mr. E. G. Hutchinson and Mr. Harold Bloor.
Honorary Auditor: Mr. W. Garbutt.

Place of Next Meeting.

Mr. Fligg, in returning thanks, extended a hearty invitation to the Association to hold its next meeting at Redcar. The matter was left to the decision of the Committee.

The President, the Committee, and the Hon. Secretary and Treasurer were heartily thanked for their services in the past year.

MANCHESTER JUNIOR GAS ASSOCIATION.

Visit to Bradford Road Gas-Works.—General Meeting of Members

The first Meeting of the Manchester and District Junior Gas Association for the 1916-17 session was held last Saturday, when, by the kind invitation of Alderman Kay, J.P., the Chairman of the Manchester Gas Committee, the members of the Gas Committee, and Mr. J. G. Newbigging, M.Inst.C.E., the Engineer to the Corporation Gas Department, the members were enabled to visit the Bradford Road Gas-Works, and inspect the new retort-house in course of reconstruction, the toluol and acid concentration plants, and other up-to-date features of gas-works enterprise which are characteristic of the Manchester undertaking.

About sixty-five members assembled at the Bradford Road station, including a sprinkling of members of the Manchester District Institution of Gas Engineers. Quite a number of members were prevented from attending owing to the war. A cheery greeting was, however, announced during the afternoon from Mr. W. Buckley, of Manchester, the Vice-President of the Association, who is in the Colonies on business.

Welcome to the Visitors.

The visitors were welcomed at Bradford Road station by Mr. J. R. Hill, the Manager of the Works, Mr. A. L. Holton, the Superintendent, Mr. H. C. Applebee, Works' Chemist, and Messrs. W. Sugden and J. Edmondson, and other officials.

The President, addressing the members, said he was pleased to see so many had accepted the invitation which had been so kindly extended them to visit the works. It was many years ago since they last visited the Bradford Road station; so that doubtless on the present occasion they would see something that was entirely new. Mr. Newbigging had written to the Hon. Secretary (Mr. Bridge) expressing regret that he could not be present that afternoon. He hoped the visit would prove both interesting and instructive to every member.

Mr. Hill said that circumstances of an important nature had compelled Mr. Newbigging to go away; otherwise it would, he was sure, have afforded him the greatest possible pleasure to have personally conducted the members round the works.

Description of Plant and Works.

The members then spent a profitable couple of hours in going over the works; separate parties being conducted by Mr. Hill and Mr. Holton, who pointed out the principal features of the Bradford Road Gas-Works—the largest, by the way, of the four stations of the Gas Department—including the toluene plant, sulphuric acid plant, the sulphate of ammonia plant, coke-breaking plant, the reconstruction of No. 1 retort house, the pan-breeze washing plant, &c.

The more important features of the works were briefly described and illustrated in the "Journal" for Nov. 2 last (pp. 248-250), on the occasion of the visit of the Manchester District Institution on Oct. 30. The work then under construction has not made the progress that could have been desired, owing to the shortage of labour, &c.; but some progress and alterations have been made, of which a few particulars of the more important are given below.

Retort-House.—One half of the retort-house mentioned as being under reconstruction is now nearly completed, and should be at work in three or four months' time.

Sulphuric Acid and Sulphate of Ammonia Plant.—To the sulphuric acid plant three cascade concentrators, each capable of turning out 5 tons of C.O.V. per day, have been added. [These to meet the requirements of the Government.] The acid not being available for sulphate-making, plant is to be laid down for the concentration of the ammonia to 25 per cent. strength, in which form it will be sold. The foundations for this plant are in hand.

Toluene Plant.—The toluene plant is now at work so far as the gas washing and rich oils distilling portions are concerned; but the second and third distillations have had to stand, owing to shortage of steam. These it is expected will be at work in about three weeks' time. The gas-washing plant has quite come up to expectations; the crude benzol produced being equal to about 4 gallons per ton of coal carbonized.

After the inspection,

The President said he desired to thank both Mr. Hill and Mr. Holton for their labours that afternoon, and, through them, the Chairman and Committee of the Gas Department, and Mr. Newbigging, for their kindness in permitting them to visit the works. He thanked them for the careful way they had explained every detail of the plant to them. They had undoubtedly seen a good deal that they had never seen before, and the time spent in the works had passed all too quickly, for everything had been of interest. It was, perhaps, rather peculiar that they should visit a gas-works and see nothing of the actual gas making, or the works themselves, except, perhaps, the new retort-house now under reconstruction. There had been so much to interest them in other features of the works—the toluene plant and the acid concentration plant, for instance. He moved that their best thanks be tendered to the Chairman and members of the Gas Committee for the privilege afforded them of visiting the works.

Mr. J. M'Nicholl, in seconding the vote of thanks, said they were, as an Association, very much indebted to Alderman Kay, the Manchester Gas Committee, and to Mr. Newbigging for kindnesses. This was not the first time the Manchester Association had had to acknowledge their indebtedness to them.

The vote was carried by acclamation.

New Methods of Gas Making.

Mr. Hill, on behalf of the Chairman of the Gas Committee and Mr. Newbigging, thanked them for the vote. He reiterated that he was sorry Mr. Newbigging had been prevented from attending the proceedings, because he knew that he took a personal interest in such Associations; and at the present time, when there was so much out of the ordinary in the way of gas making, he was sure that it must be a pleasure to them to see the latest developments that had been introduced by large undertakings. As their President had said, they had visited a gas-works that day and seen no gas making—except in the distance; but he hoped they had been thoroughly interested in the other features presented to them. He thanked them for the vote, and hoped that the evening proceedings would be profitable to the members.

The General Meeting.

The members afterwards took tea together at the Grosvenor Hotel, after which a general meeting was held; the business under consideration, according to the *agenda*, being to receive a proposal from the Council as to the resumption of the proceedings of the Association.

The meeting was of an informal character; the President reviewing at length the proceedings of the last twelve months. He said that at the last meeting of the Council the members of it thought that the time was now ripe for taking the opinion of the members as to the resumption of proceedings. The Association had not held any meetings for the past twelve months, owing to the impracticability of arranging a syllabus under present war conditions. But now some members of the Council thought it desirable that the meetings should be resumed; and he invited discussion upon the subject.

After lengthy discussion, it was unanimously decided to arrange for as full a programme as possible; the President appealing to the members to attend the meetings regularly.

In reply to a member, it was stated that the officers elected at the last annual meeting in April [see "Journal," April 13, 1915, p. 88] would remain in office for the session 1916-17.

Social Function.

The members afterwards took part in a smoking concert and social evening; the usual votes of thanks terminating the proceedings.

The Gas Engineer as Once Viewed by Other Engineers.

Full of reminiscence and anecdote is Mr. H. E. Jones. There was congratulation to him at the meeting of the Bombay Gas Company, on his elevation as a Vice-President of the Institution of Civil Engineers. This congratulation was well voiced by Mr. Samuel Spencer. Mr. Jones, referring to the matter, mentioned an interesting little incident which reveals the mistaken notion that used to exist among other engineers as to the status and work of the gas engineer. Mr. Jones said that this was the first meeting he had addressed since receiving the dignity of a vice-presidency of the Institution of Civil Engineers; and he should like to explain that he did not think it had necessarily been by any amount of hard fighting that he had reached the position. He trusted that during the long career of upwards of 45 years of semi-public service in many distant parts of the world, as well as in England, Scotland, and Ireland, he had not failed of his mission, and had not at any rate discredited the profession of gas engineer, to which anybody might be proud to belong. He also hoped that, so far as the position gave him the means or opportunity, to advance the status and to promote the distinction due to the gas engineer; this work should have his very heartiest co-operation and best service. He was much amused once by a conversation with Sir Henry Rawlinson, who was a great sewage engineer attached to the Government. He had risen from humble rank, and was much exalted at being made President of the Institution of Civil Engineers. Meeting Sir George Livesey and himself (Mr. Jones), Sir Henry said: "I must ask you two chaps to dine with me one day, and meet some real engineers." Seeing that both Sir George and himself had laid some deep foundations in the estuary of the Thames, and had carried out wharfage in bad soils; seeing, too, that they had spent between them millions of money in various parts, and had worked hard for many years in all their undertakings, which were successful and prosperous and paying good dividends, they ventured to think that Sir Henry's remark was hardly a well-considered one. But there had been an impression abroad that only those who built a railway or a dock could be accomplished engineers. There were phases and functions (he was speaking in the presence of Mr. Charles Hunt and Mr. Louis Penny) in gas-works operations which, if properly done, if properly conceived, planned, designed, and estimated, demanded the services of a properly-qualified engineer. When, however, a man merely adopted the suggestions of a contractor, and put them forward as his own work and designs, paying the contractor a special price for the job, this was neither engineering nor common honesty.

THE EFFECT OF THE WAR ON GAS-WORKS' PRACTICE.

By Geoffrey Weyman, M.Sc.

[A Paper read before the North of England Gas Managers' Association, May 6.]

Although the war has brought ruin and desolation to many Continental districts, yet in those places which are out of the direct path of invasion and conquest a strong impetus has been given to trade as a whole. Here in England we find new industries springing up and existing ones expanding in all directions. This expansion is probably the start of a new era of prosperity such as history shows to follow a great war. Periodically the cycle of unrest to which man is subject finds an outlet in war, after which comes a time of peaceful progression.

There are few who cannot say that greater personal effort has been necessary during the last twenty months. Losing a large proportion of their trained staffs, business concerns have had to face fresh developments. The congestion of railways and transport generally, the difficulty of obtaining raw materials and of delivering manufactured products, shortage of labour, and other hindrances have presented problems which have had to be solved. Those left behind have had to be much more efficient than was necessary in former days. In all this whirlwind of change, one would have thought that the careful working-out of new processes would have been impossible; but the reverse seems to have been the case. Face to face with a difficulty, an attempt to solve it was imperative; and though the experiment was not always satisfactory, it probably pointed a way to success. Knowledge once acquired, the battle was almost over.

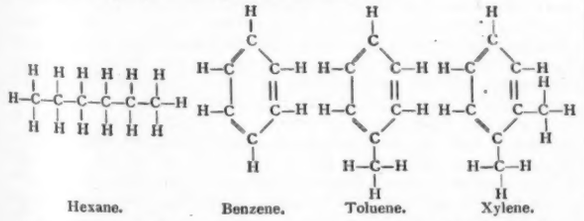
In gas-works practice the changes made as a result of the war have been very extensive, affecting every section of the manufacture. In one case a new class of bye-product has been recovered, in another the working-up of what used to be the most important bye-product is entirely changed, while the treatment and utilization of other products have been altered to suit new conditions. The result of these fresh developments has been to open-out in another direction the scientific treatment of coal.

The Scientific Treatment of Coal.

The most important and extensive development has been in connection with the recovery of benzene, toluene, and xylene. Prior to the war, practically all these substances were produced by tar-works and coke-oven works, and not till recently did the Government avail itself of the much larger supplies which were being burnt-up by consumers of coal gas. The chemical relationship of these substances to other organic compounds, and in particular to the paraffins, may be illustrated by means of diagrams. All organic compounds may be regarded as being derived from methane (CH_4), represented below by letters, each letter representing an atom and each connecting line signifying a bond or linkage.

Methane

By substitution of the hydrogen with fresh atoms, an enormous number of substances may be built-up. These make-up the class known as the paraffins, and occur naturally in petroleum. When these paraffins possess a chain of carbon atoms of six or more, they show a tendency to join-up at the extremes, forming "ring" compounds, of which benzene is the simplest, and is a basis from which a new class of compounds is evolved.



Hexane. Benzene. Toluene. Xylene.

It is the closed-ring benzenoid compounds which are so important commercially. From them we can prepare high explosives, blasting powders, dyes of every colour, artificial scents, essences, flavouring materials, medicinal preparations, even sugar in the form of saccharine. They are used in cleaning, as solvents for many substances—such as sulphur, rubber, and resinous bodies. Even if all else fails, they can be burned as a means of propulsion to greater advantage than inside an incandescent burner.

Benzene, Toluene, and Xylene.

Two processes for the recovery of benzene, toluene, and xylene were introduced. One of these aimed at the concentration of these bodies in the tar. The other involves the use of a wash-oil, and gives a more complete extraction. The former is at complete variance with the practice formerly. In a paper read before the Society of Chemical Industry in 1914, it was shown that when coal tar was separated from the gas at a high temperature, benzene was present in the purified gas to a far greater extent than if the tar and gas were allowed to cool together. Owing to the necessity under the existing restrictions of giving the gas a high intrinsic illuminating value, it was important to separate the gas and tar at as high a temperature as possible. Under the present process, the tar is cooled and then brought back into contact with the gas, which has also been cooled. In this way the tar becomes saturated at the temperature of contact; and the lower this temperature is the greater is the concentration of the benzene and toluene in the tar.

The distribution of the benzene and toluene between the gas and the tar is a definite one, depending on: (1) The original percentage of these hydrocarbons in the gas leaving the retorts; (2) the temperature of the last contact; and (3) to a certain extent on the composition of the tar. Complete saturation of all the tar per ton of coal with these hydrocarbons will not remove the whole of them from the gas, as the quantity of tar is far too small. Prolonged contact when once the tar is saturated is, of course, no further use. The maximum efficiency of the process is about 50 per cent., at which about 0·15 gallon of toluene and 0·9 gallon of benzene are left in the gas. All the way from the retorts to the condensers, the benzene and toluene are coming-down from the gas with the other hydrocarbons which form the tar progressively as the temperature decreases; and if there happens to be such a long foul main that the tar and gas are already cooled when they are separated at the condensers, extra washing will not be of much benefit.

The following figures, showing the amount of benzene and toluene found in the tar drawn off in different stages of the cooling, illustrate these points:

By Volume.	Retort-House Main.	Water-Cooled Condensers.	Air-Cooled Condensers.	Before Circulation.	After Circulation.
Crude naphtha, 145 per cent. . . .	1·84	6·27	3·08	1·63	1·42
Benzene, per cent.	0·4	3·5	2·0	0·9	0·3
Toluene, per cent.	0·4	1·1	0·7	0·4	0·2
Temperature of contact °C. . .	120	15	15	—	115

The last two columns refer to the tar circulation carried out by pumping tar from the wells through the retort-house foul main.

The value of the process lies in the fact that in most cases the amount of benzene and toluene in the tar is more than doubled, and may be worked-up with very little more trouble. The decrease in the illuminating power of the gas owing to the extraction is about 20 per cent. and in calorific value about 3 per cent.

The second process is much more efficient, giving up to 90 per cent. or more efficiency, but needs extra plant. It consists in washing the gas with an oil (usually creosote oil), which is pumped through scrubbers on the counter-current system in a similar manner to the ordinary scrubbing for ammonia. The saturated oil is then passed through heaters to the crude still at a temperature of over 130° C. The lighter vapours pass off, and the crude products still remaining in the oil are blown off with live steam. After cooling, the oil returns to the scrubbers and is used again. The crude benzol so obtained varies in quality according to the amount of live steam used and the percentage of crude benzol in the benzolized oil. An ordinary quality contains about 10 per cent. of toluene, 48 per cent. of benzene, and up to 8 per cent. or more of naphthalene. Since the ensuing fractionation is not perfect, and some of the toluene is found in the benzol, and some benzene and xylene in the toluol, the actual result is a yield of about 55 per cent. of benzol, 9 per cent. of toluol, and 10 per cent. of solvent naphtha. The remaining 20 per cent. or so is left as still bottoms.

The crude benzol is worked into unwashed benzol, toluol, and solvent naphtha in a refining still provided with a good column and analyzer; the latter serving for a further separation of the vapours. The control of the "change over" points for these fractions is best kept by trial distillation in a standard Engler flask in the laboratory—samples of the distillates being taken from time to time from the stills. Temperature indications on the stills, though useful as a guide, are not sufficiently constant, owing to interference caused by small amounts of water vapour. When the trial sample on distillation gives 90 per cent. of its volume below 95° C., a change is made to the toluol fraction, and this is continued till another trial sample gives 90 per cent. below 120, when the solvent naphtha fraction is started. Distillation is stopped when 90 per cent. below 180° C. is reached. The still bottoms are run off and cooled to recover naphthalene. These fractions are then separately washed with acid, water, caustic soda, and then water again. The washed products are then re-distilled and more carefully fractionated; intermediate fractions being taken off between the benzol and toluol and between the toluol and the solvent. Samples of products so obtained gave the figures shown in the first table on p. 274.

Up to 3 gallons, and even more, of crude benzol per ton of coal may be extracted, although to do this the washing must be efficient, and something like 60 gallons or more of wash-oil per ton of coal must pass the scrubbers. The quality of the wash-oil is an important factor. Normal creosote has a composition like that shown in the second table, p. 274. The large quantity of naphthalene is a serious drawback; and although the percentage may be materially reduced in course of time by the recovery of

Benzolized Oil—Crude Benzol to 145° C.—3·3 Per Cent.

—	Crude Benzol (with Column).	Benzol (Engler Flask).	Toluol (Engler Flask).	Solvent (Engler Flask).
Drop point ° C.	45	79	109	135
Below 80° C.	6·0	12	—	—
85	—	96	—	—
90	56	98	—	—
105	69	—	—	—
117	72	—	81	—
120	74	—	94	—
140	—	—	—	36
145	78	—	—	89
150	—	—	—	97
Benzene, per cent.	48	97	3·1	*Nil*
Toluene ,,	12	2·0	86·5	about 1 p.c.
Xylene ,, (about)	7	—	10·4	80 ,,

the crystallized naphthalene from the still bottoms, yet the introduction of fresh oil to replace wastage will bring the percentage sufficiently high to increase the naphthalene content of the gas.

—	Wash Oil New.	Wash Oil in Use 21 Days.	Blast-Furnace Oil.
Naphthalene per cent.	21·6	18·0	trace
Specific gravity	1·037	1·050	0 957
Below 200	0 5	1·5	4
220	16·5	4·5	7
240	40·5	26·5	24
260	61	51·5	40
280	70	65·0	58
300	78	72·0	72

To obtain relief from the naphthalene question, one may dilute the wash-oil either with specially prepared creosote oil or with blast-furnace oil (the latter contains little or no naphthalene, and will dissolve very much more than creosote oil); or one may let the naphthalene go forward in the gas and at the same time saturate the gas completely at normal temperature and pressure with some liquid such as paraffin.

When the gas is cooled, then some liquid paraffin will deposit with the naphthalene in sufficient quantity to dissolve and carry away the solid. To secure saturation, the gas should be brought into contact with the oil at a higher temperature than normal. Instead of heating the whole of the gas, part of it may be heated to a relatively higher temperature; so that it will pick up more than sufficient to saturate the whole of the gas when returned to the bulk.

A complete removal of the benzenoid hydrocarbons means a reduction of 50 per cent. in the intrinsic candle power, but only about 8 per cent. in the calorific value. So that the complete removal is not seriously detrimental to the consumer who uses the gas not for making a luminous flame, but for producing incandescent light and heat. However, those companies under a candle-power standard—dating back to the first introduction of gas—are placed in an awkward position. Requiring benzene and toluene on the one hand, knowing that they can recover it without affecting their position of catering to the public for the supply of light, heat, and power, yet must they pander to the municipal authorities and enrich their washed gas with some substance, such as petrol, which could be used much more economically undiluted with coal gas.

At one time benzol was used for enriching; but now that it is more valuable, we turn to the paraffins and use some kind of petrol. A good carburetting spirit will volatilize completely below 150° C., and have a calorific value of 23,000 B.Th.U. per pound. As the paraffins are of a lower specific gravity than benzene, the calorific value per gallon may be no more, and often less, than that of benzene. A rather greater volume will therefore need to be added to restore the calorific value than the volume of products recovered.

The last portion of the hydrocarbons extracted in washing is the lighter benzol, containing large quantities of sulphur compounds; but at the same time it is of considerably higher calorific value and illuminating power than the bulk. It is doubtful, therefore, if the extraction of this last residue is of sufficient value to pay for the extra amount of carburetting spirit needed.

The percentage of benzene and toluene in coal gas may in many cases be almost doubled by paying close attention to the retort-house. Roughly speaking, high heats and full retorts are the most favourable conditions. Too low a heat will produce paraffins, which will spoil such benzol as is recovered; too high a heat or too much space above the charge will tend to convert the benzol into naphthalene, owing to the radiant heat from the retort surface, while the yield of ammonia may be seriously injured.

Purification.

Passing to other changes, we find an increased value in oxide purification, owing to the larger demand for sulphur. Artificial oxides are replacing the foreign bog iron ore, and are prepared in some cases from burnt oxide in which a small percentage of soluble iron is placed. Sawdust and lime—the former to keep the mass porous, the latter to maintain alkalinity—are also added. The small amount of soluble iron seems to activate the "burnt" oxide; and though the material does not readily answer to a laboratory absorption of hydrogen sulphide, yet it does well in the purifiers, and in some cases reaches a concentration of 50 per cent. of sulphur in one fouling with revivification *in situ*.

The question of the complete extraction of sulphur in the gas is also being more closely studied. A million cubic feet of purified coal gas contains only about 40 lbs. of sulphur; so that a process to recover this must be very economical to make it remunerative. Exaggerated statements are made every day as to the damage done by this small amount of sulphur to house decorations; but it is doubtful whether the cost of the removal of the whole of the sulphur in the gas would not exceed any loss which might otherwise occur. It is interesting to note that the recovery of the benzene hydrocarbons by oil-washing very materially reduces the sulphur content of purified gas. Processes, such as the heating and contact processes, are now in operation which, when further developed, may lead to a satisfactory solution. In these cases, the carbon disulphide is converted into a more easily removed substance, such as hydrogen sulphide.

The scarcity of acid has led to the introduction of other processes for working-up ammoniacal liquor than that of sulphate plants. The manufacture of concentrated ammonia solutions is one development. Unfortunately, in this case the finished product is not fixed ammonia. Ammonia is one of the things which it seems almost impossible to handle without incurring loss, and the number of times which the ammonia is handled during its manufacture into pure ammonia solution make it imperative that every part of the plant should be absolutely tight. A recent test on a sulphate plant showed an efficiency of 95 per cent.; but it is doubtful if 95 per cent. of the ammonia entering concentrated liquor plants ever finds its way to tank-waggons.

Several of the processes for making pure ammonia solution are based on the principle that, when crude liquor is heated, the hydrogen sulphide and carbon dioxide are evolved as gases before the ammonia begins to pass off. A careful preliminary heating will therefore remove the bulk of these impurities and leave the ammonia in excess; so that a secondary simple cooling and perhaps washing will remove the last traces of these gases (which are very soluble in water containing ammonia), leaving the residue of pure ammonia to go forward, when it may be absorbed as desired. In some cases, the subsequent purification from traces of carbon dioxide and sulphuretted hydrogen is made by means of milk of lime combined with an iron salt. Pure liquor, free from all but traces of impurities, and containing up to 30 per cent. of ammonia, can be readily obtained.

The Question of Pitch.

With the shortage of freight abroad, tar distillers have become stocked with so much pitch as to be involved in great difficulties. To relieve them, pitch has been carbonized by mixing it with coal before charging the retorts. A simple means of distribution is effected by throwing the broken-up pitch on to the top of the coal-waggons and allowing the whole to go forward to the coal-breakers and charging machines.

On the whole, it would seem preferable to use the pitch for making briquettes. Now that the value of coal is beginning to be realized, there would be no hardship entailed in the enforced use of cheaper fuel for household consumption. Personally, I can say no coal has been burnt at my house for several years. Not only has the use of coke (from vertical retorts) proved cheaper, but it is now considered more pleasant. Trouble in lighting the fires can be easily got over by seeing that fresh broken coke about the size of a walnut is used to start the fire. The use of briquettes would prove a convenient transition stage between coal and coke. Vertical coke breeze containing 3 per cent. of volatile matter can be easily briquetted with 10 per cent. of pitch.

One method which is adopted on the Continent consists in grinding up the pitch, mixing it with the breeze, and then pressing the mixture into moulds in the presence of steam. The briquettes are then removed to a muffle and carbonized at a dull red heat. The finished product is a hard coke-like substance retaining the shape of the mould, burning with a small flame at first, and later giving the brilliant radiant heat of coke. The calorific value is rather higher than that of the coke from which the breeze used to make the briquette was derived. It might be of interest to point out that experiments have shown that the finest breeze dust, which, on account of its size, is the least valuable, yet has a higher calorific value than the parent coke, contains less ash, more volatile matter, and is really, apart from its size, a most valuable fuel.

Among the so-called economical processes which have recently been brought to the notice of gas manufacturers are those in which low-temperature carbonization is the principle. Unfortunately, these processes give us the primary products of coal distillation—namely, the paraffins rather than benzenoid compounds. Until some additional means are available of converting the former into the latter, or of separating them, the idea is likely to lie dormant. The most recent and economical method of carbonization in vertical retorts has a serious drawback in the tendency to produce paraffins as well as benzenoid compounds; and the recovery of the latter is seriously hampered by the presence of the former. The usual temperature of low-temperature carbonization is too low for an efficient recovery of ammonia; while the gas evolved is too rich for town consumption. The fuel also is wasteful, in that it contains volatile matter which might be more profitably used. No substance should be burnt that can be converted into useful products. We can recover neither dyes nor explosives from carbon dioxide.

The only undertakings which treat coal with a view to a proper utilization of its chemical nature, and also to a direct application of its energy, are gas-works and coke-oven works. In all other cases the coal has to pass not only into gas but into many other forms of energy before its power is manifested in mechanical energy, heat, or light. Particularly is this the case with electricity, the future of which lies with the development of solar, river, and tidal power rather than in the use of coal.

The changes that have been and are taking place in gas-works, many of which have come to stay, and only a few of which I have outlined, may be summed up by saying that gradually, year by year (and more rapidly since the war started), the value of the constituents of the gas evolved from coal are becoming greater and greater; while at the same time the enormous increase in the use of gas, particularly in connection with the production of munitions of war, proves that the purified gas has also reached a higher value than ever previously.

DISCUSSION.

Mr. W. Doig Gibb opened the discussion on the paper. He said he had come to the meeting to learn, and not to talk; but seeing that Mr. Waddom had been kind enough to ask him to open the discussion, he would content himself with a few general remarks, and would leave to other speakers the more important points referred to in the paper. He thought, in the first place, they must tender their sincere thanks to Mr. Weyman for the preparation of the paper, which reflected the conscientious, careful, and technical methods followed by him; and they knew through Mr. Hardie and Mr. Waddom that whatever Mr. Weyman investigated and put out as a fact was a fact and not merely a theory. This was the kind of man they wanted in these days to work out their technical problems. What was done in the laboratories, unless absolutely based on facts, might mean great disaster when developed on a larger scale in commercial practice. As regarded the general question of the washing-out of the constituents of the gas, it was pleasing to find that Mr. Weyman corroborated the general experience which had been found all over the country—that (in general terms), while the illuminating power in flat-flame burners was considerably affected, the calorific value to a great extent remained as it was before the benzol and toluol were washed-out of the gas. The situation was now changed. They were all aware that they first had a demand for toluol, and then it became a demand for benzol and toluol; and then came a more urgent demand for benzol. But toluol was still a very valuable constituent. This immediately took their minds from tar-washing to oil-washing. Oil-washing could not to his mind be entertained on a practical scale, unless the people who had to do it were prepared to distil their own oil. The ideal process, of course, was that where they washed with oil, they distilled immediately, took out the naphtha contents, and utilized the oil again. They thus had a complete sequence, while they only used a comparatively limited quantity of oil. But it made the process almost impossible in many works if they had to cart or rail the needful oil to the distilling works. There were, however, some processes now whereby the treatment of oil could be carried out comparatively cheaply; and he thought it was up-against everyone connected with gas production in the country to consider whether, as a commercial proposition, it was not worth their while to consider the oil-washing process rather than the tar-washing process. It looked as if the production of crude spirit in any gas-works in the country for the next ten or twelve years was going to be a proposition that might bring 20 to 25 per cent. remuneration for the capital employed. He thought almost any manager could design his own simple little distilling plant; and personally he was quite certain that the benzol production proposition for the next ten years was going to be quite a good thing for anybody who went in for it. He was there that day in his official capacity to ask whether the members could not entertain the problem of oil-washing in preference to tar-washing. He thought they would fully agree that it was a matter of importance, and that anything that could be done should be done quickly, and at the same time thoroughly well.

Mr. C. Dru Drury (Sunderland) said the subject introduced by Mr. Weyman appealed to every member of the gas industry. Sometimes they had papers which appealed to engineers, managers, or secretaries and commercial men in gas; but in the present paper they all had an interest. In the works some of them had plenty of coal, but far too much coke; others had no coke and, fortunately, had little difficulty in getting coal; but most of them had too much tar and sulphate as well. Anyway, they were all hit by the high prices of the commodities they required, and had difficulty in getting them, and were hit still harder by the shortage of labour. Happy were those who had sufficient labour-saving appliances already installed. So far as the labour question was concerned, he did not think that female labour had up to the present time been of much assistance to them in gas-works, although it certainly was in evidence in some works and probably would be extended. It was astonishing, however, how much women were capable of doing. They might have noticed in the paper read the other day that Sir William Beardmore, as President of the Iron and Steel Institute, made a rather remarkable statement. He said that the production of shells by women in a projectile factory on the Clyde was more than double the output of thoroughly trained mechanics, working on the same machines and under the same conditions. Whatever the effect of the war had been on other industries, continued Mr. Drury, it had certainly hit the gas industry, as was evidenced by the selling price of gas and the reduced consumption. Mr. Weyman, however, seemed to think these were blessings in disguise, and that gas people would in future reap the benefit by more economical and improved methods of working. Mr. Drury said he did not altogether agree with Mr. Weyman in regard to what he claimed in respect of changes due to the war. Mr. Weyman said they had been very extensive; but he (the speaker) thought the author of the paper claimed too much there, since, as far as he could see, the actual change had been the recovery of benzol, toluol, and xylene from the gas. Apart from this there had been very few changes indeed. There had been no changes in methods of carbonizing; artificial oxide was a little more used in purification; and the carbonizing of pitch was, of course, a novelty, and not very general so far. The question of pitch was a matter that might be taken up any time. Mr. Drury went on to point out that the manufacture of concentrated ammonia, in place of sulphate of ammonia, had existed for many years in several works. He did not think Mr. Weyman had quite proved his statement when he referred to the results of the scientific treatment of coal. He (Mr. Drury) did not like to feel that it had taken the impulse of the war for gas men to realize the scientific treatment of coal. It seemed to him, from the paper itself, that what had been rather boomed as the scientific treatment of coal was out of court in this particular case. Even the retorting of coal in verticals had not been bringing the benefit to the country in the shape of residuals that the more old-fashioned high-temperature horizontal retorts had done. This form of carbonizing design owed none of its development to the war. In coming to the oil-washing question, the speaker said Mr. Weyman's figures confirmed very closely those in his (Mr. Drury's) own works, where, he might say, they only proceeded as far as the recovery of the crude benzol. He might add his testimony to the important fact that a great reduction of the sulphur contents of the gas was due to scrubbing with oil. The reduction of the CS_2 and other sulphur contents took place to the extent of from 35 to 55 per cent., which was a very useful feature of the plant. On the other hand, he did not find that washing with oil increased the naphthalene content in gas. On the contrary, he found a distinct diminution; but, unfortunately, the extraction of the light oils at the same time went on, and the result had been in their case that they had very considerable trouble with naphthalene deposits in the mains and services. Fortunately, they had now been able to effect a fairly satisfactory cure by better methods of carburetting; and the figures were now not much above the normal.

Dr. Dunn, the City Analyst of Newcastle, congratulated the meeting upon having listened to such an admirable paper as that read by Mr. Weyman. It had given great pleasure to him (Dr. Dunn), and he had learned considerably from it. He had, of course, no technical knowledge of benzol or toluol extractions from gas; but it presented itself to the scientific chemist as a most interesting problem. The figures, too, that Mr. Weyman had given—comparing the two processes of oil and tar washing, and his figures showing the differences which the tar at different stages of the work presented in regard to the benzol and toluol contents—were exceedingly interesting. Mr. Weyman and Mr. Drury had compared the question of low and high temperature carbonizing, and the question of burning raw coal and converting coal into gas and getting the bye-products. The economy (he used the word in its true sense) of one process as compared with another was entirely dependent on the attendant circumstances of the time. If the time should ever come when the demand for benzol and toluol should diminish, the question would arise as to whether it would pay at all to extract them from gas in such quantities as were now profitably extracted. No doubt other uses for them might arise. They knew that apart from their use as the bases of the dyes, perfumes, and colour industries, there was, of course, the question of motor spirit, and no doubt benzol would be largely used in the future as motor spirit. Had motors and motor-engines never come into use, this outlet for benzol could not have existed; and to the same extent benzol could not have been a useful product. The cement industry had been almost revolutionized by burning raw coal in rotary kilns—powdering the coal first and blowing it into the kiln, when practically complete combustion was secured. He learnt, from what he had read in the papers, that recently efforts had been made to deal in a similar way with Siemens-Martin furnaces for making steel. He had read of a Siemens-Martin furnace worked, not by producer gas, but by blowing-in powdered coal; and certain mechanical advantages were claimed for the process—first of all for the coal as against producer gas and the subsequent burning of gas in the furnace. The solid fuel produced by the low-temperature carbonization of coal was (if domestic grates were to be used) a far more desirable product than raw coal or ordinary gas coke. He was a strong advocate of gas coke, as opposed to coal, for fires if people would only treat it properly, and not put coke in too large pieces upon their fires. But if he had gas coke and coke resulting from low-temperature carbonization, and the price of the latter was more than that of gas coke, he would never use any gas coke whatever. This presented an advantage which would aid low-temperature carbonization if the liquid products should turn out in the future to be desirable for some particular use. He merely wished to point out what was good and what was not economical and desirable, as every process depended to a great extent upon the circumstances surrounding it. When benzene

was first discovered, there were no uses for it—it was absolutely valueless; but since then it had become of abnormal value.

Mr. WEYMAN briefly replied to the discussion, and expressed his thanks for the appreciation shown of his paper.

THE SPECIAL PURPOSES SECTION.

By HERBERT LEES, of Hexham.

[A Paper read before the North of England Gas Managers' Association, May 6.]

The Special Purposes Section of this Association corresponds, with some modifications, to the Commercial Sections of some of the other District Gas Associations—a movement which was first organized by the Manchester District Institution of Gas Engineers. For some time there had been in that and other districts informal consultations among gas engineers on matters of common interest to the undertakings they represented; and it was felt that if these informal consultations could be regularized and become a part of the organization of the District Association the value of the work would be enhanced and extended. In 1902, the step was definitely taken by the Manchester District Institution, which has a Lancashire and a Yorkshire Section. The Eastern Counties Association followed, in 1906, with an Eastern and a Western Section, the North British Association in 1907 (also divided into two districts for this purpose), the Southern District Association in 1909, the North of England Association in 1910, the Wales and Monmouthshire Association in 1911, and the Midland District Association in 1914.

These sections are a natural development of the work of the larger organizations rendered necessary by the ever-growing needs of the gas industry and for the better solution of the problems which continually arise therein. The "parent" Associations will continue to do useful work, and will be none the less vigorous because of that which is done without the limelight. It is obvious, however, that large numbers of gas undertakings' officials, such as form the membership of District Associations, could not be brought together with sufficient frequency to deal effectively with questions of detail which arise in the daily management and administration of such undertakings.

There are few industries in which the workers can afford to give to each other the benefit of their information and experience so readily, and without the slightest injury to the particular undertaking they represent, as is the case with the gas industry; and the fact that there is nothing in the way of competition between them, and of their isolation, makes it the more needful that they should keep in close touch with each other, if for no other purpose than to maintain a spirit of emulation.

There is no doubt this need was experienced in the earlier years of the industry; and to meet it the British Association of Gas Managers (the forerunner of the present Institution of Gas Engineers) was formed more than fifty years ago. The same incentive was behind the formation of the various District Associations and of the Junior Associations in subsequent years; and as the need became more urgent and manifested itself in numerous ways, it was bound to find other means of attaining the end in view. Therefore, it is but natural that many organizations for the furtherence of the interests of the gas industry should grow up side by side, each helping the other and all working for the common object of increasing and demonstrating the value of the industry to the community.

THE LEEDS UNIVERSITY CHAIR.

In this connection, it may not be out of place to refer to some of the off-shoots of the work of the Institution of Gas Engineers, which have become so important in themselves as to almost overshadow the Institution itself. The work which was inaugurated at Leeds University some years ago definitely allied the gas industry with a University Chair, and thereby gave it a status to which it had not previously attained. It is impossible to overemphasize the importance of such an alliance, and far-reaching results must be the outcome. We are undoubtedly reaping some of the benefits of it now in these strenuous days, when every factor which is capable of contributing to the great cause for which the nation is at war is being harnessed for the common good.

The research work which has been carried out at Leeds must have enabled the makers of industrial gas appliances to greatly improve the quality of their goods; and we know there has been a remarkable advance in the efficiency of the gas-fire which has led to the extension of its use and, consequently, to the promotion of economy in the consumption of coal, which is one of the essential needs of the present and future welfare of this country. Moreover, an "atmosphere" has been created which is calculated to enhance the importance of the industry to those outside its ranks, and to develop in those within a stronger desire to carry on the work worthily. We have evidence of this in the way the manufacturers of gas appliances have established their own laboratories and engaged the services of scientific experts to guide them in their work; and the work of the chemist in the gas-works has been looked upon as of greater importance in recent years.

BRITISH COMMERCIAL GAS ASSOCIATION.

What Leeds University has done, and is capable of doing, for us on the technical side of our work, the British Commercial Gas Association is doing on the commercial side. Here, again, not the least of the services rendered to the gas industry by this virile Association is the creation of an "atmosphere." The educational work done, through numerous channels, has gone far to prepare the minds of the people for the adoption of new, and the extension of older, methods of using gas, and to listen to the arguments in its favour; so that it is now comparatively easy to convince people as to the advantages of gas, and to disabuse their minds of the old-time fallacies.

SOCIETY OF BRITISH GAS INDUSTRIES.

While referring to these matters, it would be unfair to ignore the part played in their development by the Society of British Gas Industries. Its co-operation in these and other movements has been of the utmost value to the industry as a whole. Whatever the future may have in store in the way of co-ordination of the present organizations or the formation of another in which the interests of all shall be represented, it must surely be acknowledged that each has done, and is doing, excellent work. There can be no standing still; and if continuous development cannot be assured on existing lines, others must be marked out and boldly followed.

THE SPECIAL PURPOSES SECTION OF THE ASSOCIATION.

But to come to the main object of this paper, which is to deal with the work of the Special Purposes Section of this Association. It took shape during the presidential year of Mr. T. H. Duxbury, at whose initiative the formation of such a sub-organization was considered by the Committee. The members of the Committee of that period will remember how fully the whole subject was considered, and with what care the rules were drafted to meet the special needs of the district, so that the fullest advantage could be obtained. There are no hampering restrictions. It has been a tradition of this Association from its inception to form no watertight compartments for different classes of officials, and what was a difficulty in some other District Associations did not obtain here. The technical and commercial staffs have met on common ground, and, therefore, there was no need to discuss the question of precedence. Moreover, the intention was to make the Section as wide in its scope of usefulness as was possible. To this end, secretaries, engineers, and managers are eligible to represent their respective undertakings; and, according to the size of the undertaking, one, two, or three representatives may be elected. The subscription is also graduated according to size. Even this wide range was not strictly adhered to, as provision is made in the rules for the co-option of not more than three personal members who, by reason of their professional knowledge and experience, are qualified to assist in advancing the objects of the section.

Membership of this Association is an essential qualification in every case. Further, the Committee may invite the attendance of others who may be able to give useful information on the subject under discussion at any particular meeting. After nearly six years' experience, it may unhesitatingly be said that the constitution has worked smoothly and to the general advantage of the undertakings forming the section. This is the more gratifying because of the fact that it was adopted without discussion, at a general meeting (which is memorable as synchronizing with the death of King Edward VII.) when nothing but matters which were strictly essential were dealt with, and no one was in the mood for raising controversial points. Acting on the instructions of that meeting, the "Special Purposes Section" was brought into being during the summer of 1910.

EDUCATION OF GAS-FITTERS.

A perusal of the records shows that some of the earliest work in the section was in connection with a scheme for the better education of gas-fitters. During several winters a series of lectures were given at various centres by gentlemen specially qualified to speak on some particular phase of their work; and in this way practically the whole ground of the work of a modern gas-fitter was covered. These lectures were not confined to gas undertakings' employees, but were attended by master plumbers and their workmen in considerable numbers. The attendance was good throughout; and, in addition to the direct benefits to those who took advantage of them, they had the effect of bringing the master plumbers into closer, and more friendly, union with the gas industry. This is likely to prove a permanent benefit both to the gas undertakings and to the master plumbers. It has already been directly manifested by their co-operation with a Committee of the section in a scheme of more permanent and practical value of an educational character, which has unfortunately been held-up for the present owing to the conditions brought about by the war.

DEALING WITH INACCURATE STATEMENTS.

Another matter which was brought to the notice of the section very soon after its formation was the fallacious information contained in some text-books on "Domestic Economy" in relation to the hygienic effect of gas when used for certain purposes. The attention of those responsible for this teaching, and that of Commercial Sections in other districts, was drawn to it at the time. Since then the British Commercial Gas Association have taken up the matter, and have worked in the direction of removing such fallacies But they "die hard;" and even education authorities and alleged experts require to be educated in some things—and this is one of them. It is, therefore, important that whenever

these ancient and inaccurate statements are found, in any guise whatever, they should be promptly dealt with.

Another case of giving a false view in regard to gas was that of an advertisement which was being issued in the form of a leaflet by a firm whose artist had allowed his imagination to run riot, and had thus produced a picture which was much more startling than accurate. This was promptly brought to the notice of the section, and, as the result of correspondence on behalf of the section, backed-up by some of the gas undertakings in the district, the leaflet was immediately withdrawn. These may seem small matters; but they are by no means unimportant.

Obtaining Increased Consumption per Consumer.

The subject of "methods for obtaining an increased consumption of gas per consumer" occupied a portion of the time of each meeting for many months; and during this period some very valuable information was placed before the members. There is scarcely a phase of the subject that did not receive attention. When this question was under consideration, the formation of the British Commercial Gas Association was taking shape; and it is not claiming too much to say that the discussion was helpful to many of the members in making up their minds to associate themselves with this forward movement. Also, in the course of impromptu discussions and conversations, which are a regular feature of the meetings, the great value of the work which the Association was destined to do was emphasized again and again, and not a word said in this direction needs to be withdrawn or qualified to-day. If there were any who were doubtful of the good that would accrue from the movement, they have long since become whole-hearted supporters of it. And, after all, that is the best way of ensuring success.

At a later period, when the arrangements for the gas exhibition in London during the autum of 1913 were under consideration, the section was again instrumental in bringing to the knowledge of the members such information as would enable them to approach their respective boards or committees more confidently when asking for support for it; and, consequently, a wider interest was created than would otherwise have been the case.

District Conferences.

During the week of the annual meeting of the British Commercial Gas Association held at the exhibition, the question of District Conferences was under discussion at a meeting of representatives of the various District Associations; and, as the result, such conferences were held at a number of centres, one of which was Newcastle-upon-Tyne. In co-operation with the Committee of this Association, the Special Purposes Section organized that conference; and there can be no doubt that the fact of having such an organization ready to hand was a very great factor in accomplishing the remarkable success that was achieved. It is known to the writer that some of the gas undertakings which had previously stood aloof have since become supporters of the British Commercial Gas Association in consequence of what they saw and heard on that occasion; and it also did good work in more firmly attaching to it others who had previously sympathized with its aims. These were not, by any means, the only benefits that were produced.

Sulphate of Ammonia Association.

The work of the Sulphate of Ammonia Association has also received the consideration of the members of the section from time to time, and questions of special interest have been brought to their notice, with the result that a more intelligent appreciation of its objects and possibilities has been created, and increased support has been obtained for it.

Matters Affecting Workers.

It will be remembered that when the Workmen's Compensation Act, 1897, came into operation, this Association, through the Hon. Secretary (Mr. J. H. Penney), gave considerable assistance to the gas undertakings represented in its membership in obtaining terms for covering the Employers' Liability risks, which were much better than could be obtained by individual undertakings; and from time to time this matter has since received the attention of your Committee. Since the formation of the Special Purposes Section, the National Health Insurance Act, 1911, has been placed on the Statute Book; and this created a host of problems in reference to the unemployed section of the Act which affected certain classes of gas undertakings' employees. The opportunity of being able to confer on these questions from month to month, while these points were under the consideration of the Umpire appointed by the Government to deal with such questions, was of inestimable value to the members. The methods of administering the provisions of the Act were also discussed with advantageous results. This work could not have been done in other circumstances.

Administration.

There are perhaps few vocations which provide more interesting problems and topics for discussion than are to be found in the duties of the various officials of a gas undertaking. In the administrative department such questions of "labour saving appliances in offices" have been brought to the notice of the section by practical demonstration of what could be done, and the economical benefits that have accrued from their adoption. The work of the Sheldon School of Business Building was prominently brought to its notice, and information on the results of a class in this district were reported subsequently. "Third Party Insurance" is a subject upon which some useful information has been forthcoming.

Income-Tax Assessment, &c.

The scheme of the Inland Revenue authorities for the assessment of gas undertakings for income-tax, with special reference to depreciation allowance, which was inaugurated a few years ago, received attention at one or more meetings, and members were enabled to appraise the value of the scheme with fuller knowledge. Rating assessment, land valuation, contract agreements, and such-like matters come up from to time as one or other of the members desires to have some point elucidated.

High-Pressure Lighting Charges.

The question of charges for high-pressure lighting has received the attention of a Committee specially appointed for the purpose, and some very useful information was collected and tabulated for the benefit of the members.

Doctors and Architects and Gas.

Following the Manchester meeting of the British Commercial Gas Association, at which Mr. H. H. Creasy read a paper on "A Campaign among the Doctors," new interest was created in this subject, and members were induced to inquire into the condition of things in this regard within their respective districts, and urged to take such action as would tend to a more general recognition by the medical profession of the advantages of gas for heating purposes. In the same connection the importance of bringing to the notice of architects the many advantageous uses of gas for a variety of purposes was emphasized.

Welded Joints, Automatic Lighters, &c.

Information on the subject of welded joints of steel mains was laid before a meeting, and the members had an opportunity of seeing a demonstration of such work which was being carried out by the Newcastle-upon-Tyne and Gateshead Gas Company. High-pressure mains and installations, the automatic lighting and extinguishing of street lamps, the registration of meters at pressures above normal, and a number of other matters relating to the distribution and uses of gas have been the subject of discussion.

Coke and Other Bye-Products.

Methods for developing the local sales of coke come under discussion occasionally, and anything that has been successful in one district is mentioned for the benefit of others who may not have tried it. It may be said here that no attempt is made to interfere with the prices charged for this or any other residual; but it follows that if the popularity of these commodities in the locality in which they are produced can be increased, there must be some advantage to the seller without any disadvantage to the buyer. This will be obvious to all who have to handle coke; and if economies can be effected in any way, the price of gas is favourably influenced thereby.

The residual products of the manufacture of gas are becoming increasingly important to the nation—coke, from the point of view of fuel economy and smoke abatement; tar, in normal times, for road making and maintenance, in addition to products it contains which are essential for other purposes, and especially so at the present time; and sulphate of ammonia, for agricultural purposes. These are matters which receive regular attention at the meetings of the section, and members are in possession of the latest information for dealing with the commodities advantageously.

There are a "thousand and one" questions to discuss; and it would be impossible to recapitulate and summarize them, even if it were desirable, and not wearisome, to do so. No subject that is of interest to any member is debarred. However unimportant a subject may appear to others of the members present, it receives respectful attention, and the questioner invariably obtains the help he is seeking, and goes back to his duties with his problem solved or with enough information to enable him to work his way through it.

War Problems.

The war has brought its own problems, and, valuable as the section was before, it has become doubly so now. The labour difficulty and methods of meeting it so as to liberate as many eligible men as possible for the Army and Navy, have frequently been the subject of conversation; the production of toluol and the disposal of tar in order that the toluol should become effective in its proper place and manner. Many of these problems are only partially solved; but it is of immense advantage to be able to compare notes periodically.

Naphthalene.

What troublesome days and anxious nights have been spent over the question of naphthalene stoppages. It cannot be claimed that these can be removed, and a definite and permanent solution of their cause and cure obtained, by a dozen men sitting round a table. But if they are able to compare their experiences and methods of dealing with the elusive foe, each must obtain some fresh light on the subject, and will return to his task with some new suggestive idea which will stimulate him to further effort. This is illustrative of numberless questions with which a gas

undertaking's official is faced in his daily round. He gets to know how other men are tackling the problem which he is trying to solve; he obtains the benefit of their experience; he learns of failure and of success; he adds his own knowledge to the common stock; and he returns to his work greatly helped and enheartened in his work. This is what happens to a man who attends the meetings of the Special Purposes Section.

Joint Conferences.

When questions of more than local importance arise, as occasionally happens, the Commercial Sections throughout the country confer; and it has been customary to have a Joint Conference during the week of the annual meetings of the Institution of Gas Engineers. An interchange of reports takes place, and generally each district has some knowledge of what is being done elsewhere. The writer has been in correspondence with the Secretaries of all the other like organizations, and he is able to say that it is the unanimous opinion of these gentlemen, which is confirmed by others, that the work of the sections is of untold value to the gas undertakings that take advantage of their usefulness. This is certainly the view held by those who attend the meetings of the Special Purposes Section of this Association; and although some had great expectations of its value at the outset, those expectations have been more than realized.

Value of Co-operation.

The day has long since passed when any official or undertaking desirous of being in the van of progress could hope to attain this object by adopting a policy of isolation. The lesson of co-operation and co-ordination is being taught anew on a gigantic scale just now; and an industry which has everything to gain, and nothing to lose, by working in this direction cannot afford to neglect any opportunity of doing so that offers. If a number of undertakings stand aloof from such work as is referred to in this paper, the highest possible result cannot be obtained. All the forces that can be mobilized are essential to complete success. It is, and must ever remain, a voluntary movement; but there is no advantage to the man who digs his own trench and sleeps in his "dug-out" alone. He is safer, and much more useful, if attached to his regiment.

DISCUSSION.

Mr. W. Hardie (Tynemouth) spoke of the great importance of the question dealt with by Mr. Lees. He said he attended the meetings of the section referred to with great pleasure; and when he had an item at the works troubling him, in engineering or commercially, he found he could always gain some benefit by talking it over with representatives from other gas undertakings at the sectional meetings. He was convinced of the enormous value of gas coke for household purposes. They knew that all the local gas companies had increased their sales very largely, because people had realized that it was not only more economical than coal to buy, but at present it was more patriotic to use it.

Mr. Charles Wood (Bradford) could not understand why there should be any necessity to urge members in the North of England district to come into the Special Purposes Section. He had been President for thirteen years of the Yorkshire Section of the Manchester Institution, and everybody was in it.

Mr. T. M. Waller (Durham), speaking as one who was not a member of the section, said it was regrettable that there were so many different societies, instead of one strong central body; and he cited the various Chambers of Commerce throughout the country with their different sections of traders, but all affiliated with the National Associated Chambers of Commerce.

Mr. S. Shadbolt, a member elected that day, testified to the value of the Special Purposes Section.

Mr. F. P. Tarratt (Darlington), said he came forty miles each month to attend the meetings of the section, and he thought this a light matter in comparison to the benefit he derived by conferring with other of the representatives of gas undertakings. Mr. Waddom was connected with a great gas concern, and he thus had very important figures at his finger ends which were always at the disposal of the meetings of the section. In this way, they got ideas, and were able to go back to their works and make valuable suggestions.

TWO MANUALS OF CHEMICAL TECHNOLOGY.*

We have before us two recent additions to the series of Manuals of Chemical Technology which are being issued in rapid succession under the general editorship of Dr. Geoffrey Martin, who has had the benefit of the assistance of specialists on the subjects dealt with. Of the two books now under notice, one is on the "Salt and Alkali Industry," and is not therefore of very direct value to readers of the "Journal." Soda is, however, a product which is of such wide application in all branches of chemical industry and in the arts generally, that information as to its manufacture cannot fail to be of interest to all technical men, and on that account we do not doubt that the manual on the "Salt and Alkali Industry," by Messrs. Martin, Smith, and Wilson will prove to be one of the most successful of the series.

The sixth chapter, which deals with the "Manufacture of Soda by the Ammonia Soda Process," appears to be the best in the book, doubtless because, as is pointed out in the preface, Mr. Stanley Smith has special works' acquaintance with this process. The earlier chapters give more sketchy and disjointed accounts about the salt industry, and the manufacture of hydrochloric acid, salt cake, and soda crystals and caustic soda by the Leblanc process. The book closes with two short chapters on the "Stassfurt Industry" and "Potassium Salts." It is not perhaps the fault of the authors that those who are suffering from the cessation of imports of potash salts from Germany will find in these chapters little help in their research for alternative sources of supply. Were a continuance of the high prices for potash salts now current in Allied and Neutral countries assured, many alternative sources would be developed even in Europe, and some of them in any case are likely to survive in America, where fiscal and natural conditions are more favourable to their evolution and establishment.

The statistics given in the book are for the most part hopelessly antiquated in relation to a highly progressive industry. For instance, this country's output of rock salt, salt in brine, &c., is given for no later year than 1907, and the quantity is said to have remained fairly constant for several years past. The output in 1913 was, nevertheless, 13½ per cent. higher than in 1907, and 1914 showed only a slight set-back, due to war conditions. It is the same with quantities exported, and the output in other countries—much later data than those quoted by the authors are available.

The manual on "Sulphuric Acid and Sulphur Products" should be of more direct value to most readers of the "Journal," to whom, moreover, the name of Major J. Louis Foucar, of the Gas Light and Coke Company, as author, would have made a direct appeal. Unfortunately, Major Foucar was killed in action on May 8 last, and all will mourn the loss to the country and the gas industry of one who modestly referred to himself a few years earlier as "an earnest student of science in general and of chemistry in particular." He had, however, before he left to serve in the field, prepared much valuable material for the present volume; and Dr. Martin has utilized this and added to it.

The manual comprises four chapters and an appendix of conversion tables. The first chapter is a short one, headed "The Sulphur Industry," in which some particulars are given of the extraction of native sulphur, the recovery of sulphur by the Chance-Claus process, and the properties and uses of sulphur. The second chapter, which is on "Sulphuric Acid," forms three-fourths of the whole of the manual. It embodies a good deal of valuable information, but is marred by want of care and thoroughness in the assembling and the co-ordination of the information. Often in its pages attempts have been made to describe numerous types of apparatus or plant for particular purposes; but the descriptions are so sketchy, and lacking in essential detail, that they become of very little service. It would have been better, in our opinion, to have made this part of the book less comprehensive, and to have aimed at greater thoroughness in the subject-matter retained. As it stands, the patchiness and incompleteness of the chapter has an irritating effect on the reader, rendering him inappreciative of the information which it really contains. The matter dealt with includes the roasting of pyrites, zinc blende, and galena, as well as the burning of sulphur and sulphuretted hydrogen, for the production of sulphur dioxide; and the formation of sulphuric acid from the latter by both the lead chamber and the contact or catalytic processes. There are also some particulars of the methods followed in the purification and concentration of chamber acid, and in the transportation of acid of various strengths.

The third chapter consists of two pages dealing with the manufacture of anhydrous sulphur dioxide and of commercial sulphurous acid. The fourth chapter is slightly longer, and includes brief accounts of the manufacture and properties of carbon disulphide, and of sodium thiosulphate and hyposulphite.

There are many lapses of grammar, expression, and spelling, which may perhaps be ascribed to the depletion of the ranks of publishers' proof-readers owing to calls for military service. But some of these lapses are unfortunate—even an embryologist will get but an imperfect idea of the smell of commercial carbon disulphide from its description as *fœtal*.

Both this book and that on the Salt and Alkali Industry should prove useful to students preparing for examinations at technical colleges and schools, and should stimulate the more inquiring and thorough among them to seek for further guidance in the literature to which the authors give very full references. They may also be of appreciable, although less pronounced, utility to men who have emerged from the training colleges into industrial undertakings.

* (1) "Sulphuric Acid and Sulphur Products," by Geoffrey Martin, D.Sc. (Bristol), D.Sc. (London), Ph.D., Technological Chemist, and Major J. Louis Foucar, B.Sc. (London), Chemical Engineer, late Assistant Manager at the Beckton Gas-Works. London: Crosby Lockwood and Son; 1916.

(2) "The Salt and Alkali Industry," including Potassium Salts and the Stassfurt Industry, by Geoffrey Martin, D.Sc. (London), D.Sc. (Bristol), Ph.D., Technological Chemist, Stanley Smith, M.Sc. (Birmingham), Chemist to the Ammonia Soda Company, Limited, and F. Milsom, B.Sc. (London), Technological Chemist. London: Crosby Lockwood and Son; 1916.

The "Journal für Gasbeleuchtung" for the 22nd ult. contains the preliminary notice for the 57th annual meeting of the German Association of Gas and Water Engineers, which will be held in Berlin on Wednesday, June 28.

THE SULPHUR IMPURITY OF COAL GAS.

By Professor Frank Clowes, D.Sc. (Lond.).

[Abstract, prepared and revised by the Author, of a Paper read before the London Section of the Society of Chemical Industry, Monday, May 1.]

Although the progress made in the removal of the sulphur impurity in coal gas has, until recently, been very slow and unsatisfactory, its removal is a problem which has always been of the greatest interest to chemists. The recent progress will be best appreciated by presenting a short summary of the past and present state of the matter within recent years.

Coal may contain from about 0·5 to 4 per cent. of sulphur, which is partly present in inorganic and partly in organic compounds. Good gas coal should contain not more than 2·5 per cent. of sulphur. The modern method of carbonization at high temperatures in fire-clay, instead of iron, retorts ensures a larger yield of gas, but also causes a larger proportion of sulphur from the coal to pass into the gas; and, unfortunately, this increase in sulphur is mainly in the form of sulphur compounds of an organic nature, which have proved difficult of removal, and not in the form of hydrogen sulphide, which can be readily dealt with. The crude gas escaping from the retorts may contain 1·6 per cent. by volume of hydrogen sulphide and 0·03 per cent. of vapour of carbon bisulphide and other organic sulphur compounds.

These sulphur impurities distribute themselves among the products obtained in the purification processes. The tar and the ammoniacal liquor contain some of these sulphur impurities; but reliance is mainly placed upon hydrated ferric oxide for the removal of the hydrogen sulphide, and the organic sulphur compounds are in some works subsequently, in great part, removed by "sulphided lime." This sulphided lime is prepared by passing coal gas containing hydrogen sulphide, but free from carbon dioxide, over freshly-slaked lime. Its use removes the remaining sulphur impurities incompletely, and sulphur equal to 10 grains per 100 cubic feet still remains in the gas; while the gas maker maintains that, as a purifying agent, it is uncertain in its action, and that its removal is attended with nuisance and with injury to the health of workmen.

As a rule, the purification by sulphided lime is only carried out in those gas-works which are required by law to keep the proportion of sulphur in their gas supply within a limit of about 20 grains per 100 cubic feet. This has until recent years been the case with the large Metropolitan gas undertakings, and with a few other of the big centres; but the process of sulphur purification has usually been a voluntary one, and has not been extended beyond the removal of hydrogen sulphide by means of oxide of iron. This purification by iron oxide alone is entirely satisfactory when carburetted water gas is used, since water gas is free from the sulphur compounds other than hydrogen sulphide, though it contains much of that gas.

The London gas supply has been under stringent requirement of purification for a special reason. Originally, the Metropolis was supplied by an unnecessarily large number of gas companies, and difficulties arose with regard to conflicting areas of supply. The Gas Act of 1860 recognized certain areas of supply for a limited number of companies; and in return for the monopolies thus created, special limits of impurity in the gas were enacted, and the necessary machinery for prescribing methods of testing the gas and for carrying out the tests was subsequently arranged. The total sulphur in the Metropolitan gas supply was not allowed to exceed 17 grains per 100 cubic feet in summer and 22 grains in winter.

These limits were applied to, or adopted by, a large number of Provincial gas undertakings. Statistics obtained in 1903 showed that 28 Provincial companies had sulphur limits legally prescribed —17 having a limit of 20 grains, the remainder varying between 18 and 32. Other returns showed that 66 Provincial companies who were under no legal limitations voluntarily purified their gas to a similar degree, as shown by their own tests. Some of these reduced the sulphur to 8 grains per 100 cubic feet; some even lower than this. Returns obtained in 1901-2 showed that at least 60 per cent. of the entire gas supply to England and Wales was under either compulsory or voluntary sulphur limitation. Five large Continental towns were under sulphur limits varying between 17·5 and 26 grains. These towns had a supply under the Imperial Continental Gas Association.

In 1904, however, the Metropolitan gas companies asked to be relieved of the limitation prescribed for the sulphur impurity; basing their request mainly on the uncertainty in working of the sulphided lime process, and on its offensive and unwholesome product. It was also suggested that the gas consumers in districts where this purification was not carried out made no complaint of their supply, and also that the introduction of the mantle burner certainly led to a considerable reduction in the amount of gas burned for illuminating purposes, and to a corresponding diminution of the amount of oxidized sulphur products thus introduced into the atmosphere of our dwellings. The Board of Trade appointed a Committee, on which both scientific men and the gas industry were represented, to inquire into this request, with a view of legislating on this and on other matters raised by the companies. The London Gas Act was the legislative result, embodying the recommendations of this Committee.

It will be of interest to look into the evidence submitted to the Committee by various experts, since it represents the most recent knowledge on the question of sulphur impurity in coal gas. The decision arrived at by the Committee is certainly of the greatest importance, because it directly led to the discovery and perfecting of a new method of sulphur purification by our President and certain members of his staff which cannot fail to be of the greatest interest and importance to the gas industry generally.

The Board of Trade Committee decided to recommend a method of testing for the hydrogen sulphide impurity in coal gas which was considered to be less stringent than that in use. A wet lead-paper was to be exposed to the gas, at intervals, for three minutes only—instead of a dry paper being exposed continuously for at least fifteen hours. Opinions differed, however, as to the relative stringency of these two methods of testing. But the more important decision was relative to the sulphur compounds other than hydrogen sulphide. Basing their opinion mainly on the difficulties stated by the gas companies to arise from the use of sulphided lime and "the fact that no effective substitute for lime has been found . . . they are of opinion that the requirement that the sulphur impurities should be removed to such an extent as to demand the use of lime should be discontinued. They refrain from suggesting the imposition of any modified restriction in place of that now existing . . . but that official tests should continue to be made, and that the amount of impurity should be ascertained and recorded."

It was inferred from the experiments made by the gas companies with disuse of lime, that the total sulphur in the gas would not exceed 35 to 40 grains of sulphur per 100 cubic feet. This main ground for the decision of the Committee will be adverted to later on; but two other grounds on which the decision was based may now be considered.

It was assumed that the absence of complaint by the gas consumers in districts where lime purification was not used was evidence that the additional amount of sulphur in such gas supplies was not prejudicial. But it must be remembered that there was available an alternative electric illuminant for the use of those consumers who appreciated the objection to the impure gas supply; and the chemist who has had to protect the ignorant or careless consumer against the impurity of his supply of foods and drugs will not be largely influenced by the absence of protest from the indifferent consumers of impure gas.

Another ground for the Committee's decision was stated to be that the evidence as to the prejudicial effect of the sulphur impurity was of a conflicting nature. There was, however, evidence furnished of the objectionable and destructive effect of the oxidized sulphur products from gas combustion, which was not disputed, and appears, indeed, to be irrefutable.

Dr. Haldane gave it as his opinion as a physiologist that the presence of the sulphur products of combustion in any degree in the air of a room would cause discomfort to the average person, and was objectionable, on the score of health, in the case of delicate persons. He found that gas not purified by lime caused discomfort of the kind referred to. At the same time the sulphur products would be of little, if any, value for disinfectant purposes, since 0·06 per cent. of sulphur dioxide in the air was fatal when breathed by men or animals, while air employed for disinfectant purposes contained not less than 15 per cent. But the destructive effect of these oxidized sulphur products on leather and fabrics was the most serious fact; and this was abundantly proved by the experiments of Dr. Gordon Parker and others, and was endorsed by a Committee of the Royal Society of Arts, consisting of leather experts and chemists.

These experiments proved that the products of the burning of sulphur-containing gas caused leather to become rotten, and ultimately to crumble away to dust. They showed that this effect was produced on leather which was originally free from acid, and that it was by the absorption of acid from the products of combustion that the destruction was brought about. It was proved, also, that no permanent damage was caused to leather by merely heating it for some time even to 180° Fahr., and that the damage was, therefore, entirely due to the sulphur acids. This damage and destruction was shown to be produced on other fabrics, and it was proved that not only the bindings of books in the library, but also the leather and fabrics used in the furnishing of the house, were subject to the same result. A possible objection, that bookbindings rotted in libraries where no coal gas had been burned, was readily explained by the fact that leather is sometimes prepared and dyed with the use of sulphuric acid, and that such leather retains this acid against all washing processes. The free acid is, however, only present in more modern samples of leather; and it is these leathers which rot, and not those of an earlier date.

It can hardly be imagined that one would willingly allow so destructive an agent as the sulphur product to be introduced into the internal air of a house, and then rely on its rapid removal by ventilation or other means; since its complete removal could not be immediately effected and secured before some damage was done. It was stated, however, that the plaster and freshly limewashed surfaces of the ceilings and walls of a room would remove these destructive substances; but, as a matter of fact, the surface presented to the air of the room is usually protected by the use of size, even if it is not coated with paint, varnish, or glaze, or if it does not consist of some utterly ineffective substance such as wood.

It certainly behoves us to avoid the unnecessary combustion of impure gas in our rooms, since this adds to the oxidized sulphur

products which may occasionally arrive from the external air of the central parts of our large towns. Unfortunately, the continued use of raw coal in the domestic grate is producing sulphur acids in the external air; and although these are constantly and rapidly removed by wind and rain and by ordinary atmospheric circulation, there are times of stagnation and fog when their removal is very slow. Experiments have proved, however, that these acids are rarely present in town air in the free state, but are neutralized and rendered comparatively innocuous by the ammonia also evolved from coal on its combustion in the grate. It has been also shown that the coal gas which has been purified from ammonia in the gas-works furnishes free sulphur acids, during combustion, from its sulphur impurity, and the free acids may be detected in the internal air of our rooms. The smoke and other products of the combustion of raw coal are, however, rapidly decreasing in amount, as heating and cooking are being increasingly done by means of coal gas or electricity. By securing the purity of coal gas, this improvement will be materially assisted in the external air; and the condition of the internal air of rooms in which gas is burned in the open for heating and illuminating will become unobjectionable.

There is no doubt, however, that the decision of the Board of Trade Committee was mainly influenced by the strong objections raised by the representatives of the gas companies against the use of sulphided lime, and by the fact that no efficient, inoffensive, and unobjectionable substitute for this purifier was known. But this difficulty has recently been removed, since Mr. Charles Carpenter, D.Sc., the President of our Society, working for some years in co-operation with officials of his Company, has perfected a simple, economical, and successful process for largely reducing the sulphur impurity of coal gas without the use of sulphided lime. It is probable that the incitement to perfect this new process arose largely from the statements made before the Board of Trade Committee and from the decision at which the Committee arrived.

The investigation which resulted in the new process proceeded on the idea, which had long been held, that the most practical method of reducing the amount of sulphur compounds, by the removal of the carbon bisulphide, would consist in suitably heating the gas, and then removing the hydrogen sulphide thus produced by means of iron oxide. During the many years of this experimental investigation it was proved that the readiest means of effecting this purification was by passing the gas at a temperature of about 450° Fahr. over fire-clay surfaces impregnated with reduced nickel. Under this treatment the carbon bisulphide and free hydrogen in the coal gas furnished carbon and hydrogen sulphide. This hydrogen sulphide was removed by subsequent exposure of the coal gas to iron oxide, and the carbon deposited on the fire-clay-nickel surface was then burned off, leaving the surface again effective for continuing the purification of the gas. By this procedure the sulphur of the coal gas was reduced to about 8 grains per 100 cubic feet.

The perfecting of the process involved a careful study of the most suitable surface for inducing the chemical change at a low temperature, such as would not be injurious to the useful intrinsic qualities of the gas; it also involved much ingenuity in devising methods for bringing the gas to the required temperature and maintaining it at this temperature for the necessary time.

The process has now been working continuously in four of the largest works of one of our large Metropolitan gas companies for periods varying from two to three years. It has continued throughout this time to show unimpaired efficiency, has developed no practical difficulty, and its control has amounted to the simplest routine; while its results have given satisfaction alike to the sales department of the company and to the consumers of their supply.

It may be stated that another somewhat similar process, depending on a different chemical change, seems to promise equally good results in the hands of an investigator in France. And there can be no doubt that the success attained by our countrymen will not only greatly encourage the further development of the process of our military ally, but will also lead to the practical realization of another process which promises to remove the larger portion of the sulphur which still remains in the gas after the removal of the carbon bisulphide.

It is therefore certain that the immediate possibility of distributing a much purer gas supply is now presented to the gas maker; and it is to be hoped that those concerned in the great gas industry will quickly avail themselves of the opportunity thus afforded them of placing the industry in a strong and impregnable position in the face of serious competition, and of giving their consumers the satisfaction of burning a gas which is almost unobjectionable.

DISCUSSION.

The Chairman (Mr. Arthur R. Ling) said that the most interesting and instructive paper which had been listened to was on a question of very great public importance. It was not a subject of which he knew much personally; but there were present several authorities upon it. In the first place, he would ask the President of the Society to open the discussion.

Mr. Charles Carpenter, D.Sc., said he did not know that he could add much to the interesting history which Professor Clowes had given on what was called for so many years the "Sulphur Question in London." He could emphasize the difficulties which had been referred to, under which those who were responsible for the conduct of gas undertakings in London suffered for many years while the restrictions were in force. As Professor Clowes had pointed out, it was perhaps not altogether satisfactory, from the chemical standpoint, that so many years should have gone on during which a great many people were alive to the importance of sulphur purification in London; and yet, despite the fact that so many able scientific men had given their attention to the problem, it seemed, as regards purification by means of lime, to be an unsolved one. He had had the hope for a good many years that he might be so fortunate as to put this question on a more or less satisfactory basis; but the necessity for doing this fell to the ground when the great convenience of the catalytic process made itself manifest. The curious thing about the catalytic process was that in practically all its details it was suggested and foretold twenty or thirty years ago. There was hardly a detail throughout which had not been foretold. The method of heating the furnace by means of gas-producers, for instance. Sir William Siemens was the first to turn his attention to this; and from this point of view the Siemens furnace was a great advance. The question of the catalyst was another detail; and the breaking-up of the gas into a great number of small currents was another. The use of an absorbent, a real absorbent, for carrying the catalyst was also suggested; and there was hardly a single item of the plant as it existed to-day that was not suggested in one way or another quite twenty years ago. He did not propose to deal with the sulphur part of the problem, because this had been dealt with so fully by Professor Clowes; but he would like to emphasize the great moral to be drawn from the successful achievement in putting this process on a working basis and making a working success of it. The whole point was that in the past engineers of reputation worked out different problems from their point of view, while chemists of reputation worked out different problems from their point of view. To some extent they worked in collaboration; and perhaps one of the best examples of this was to be seen in the gentleman who was present that evening and who was described as the *doyen* of the gas industry—namely, Mr. Harry Jones. He believed he was right in saying that, of all those who had applied themselves to the problem of the extraction of bisulphide of carbon, he was the only one who had successfully done it. He obtained a process which took the bisulphide of carbon out of the gas, and which also gave the sulphide in the separate form by which it could be used for other purposes—in other words, he recovered the bisulphide of carbon as a bye-product. This was the only example he knew in which bisulphide of carbon was treated in this way. But there was even to-day a feeling on the part of the engineer that his domain was being entrenched upon by the chemists, and a similar feeling on the part of the chemist that he was the only person who knew all about it, and that the engineer knew nothing. He remembered that the late Sir George Livesey, who was a particularly broad-minded man, used to speak very disdainfully of the trouble that chemists had been to him, and he remembered that even within the last few years a very able physical chemist had said what stupid people engineers were. He did not, however, think that engineers were very stupid; and the real lesson of this process was—and this was germane to the present state of things—that there were just as good brains in this country as in any other part of the world, and that the reason why Germany had obtained a monopoly in respect of the chemical industry was that she had taken advantage of her opportunities. We here had the same opportunities, but had not taken advantage of them. In addition, chemists had been particularly backward in collaborating with engineers; yet the relationship between engineering and chemistry to-day was extremely important. If industrial chemistry in England was to be what he believed it could be, it was only to be secured by collaboration between engineers and chemists.

Mr. Harry E. Jones said that Mr. Carpenter had generously mentioned that which he believed could be considered a substantial fact—namely, that he had, in his own humble way, and working with a chemist, hit upon a process which aimed at reducing the sulphur and making gas as pure as it was possible to get it. The sulphur was brought down to 6 grains per 100 cubic feet—a very low result—and at the same time it recovered, as Mr. Carpenter had said, all the valuable sulphur for making sulphuric acid and to some extent bisulphide of carbon. Mr. Carpenter himself had been somewhat staggered when, having got to the like point of success, he realized that he (Mr. Jones) had discovered the same position years before. In doing so, however, he had the assistance of a very clever chemist, Mr. Leicester Greville, who had been assistant to Mr. Keates, who was Dr. Clowes's predecessor at the London County Council (then the Metropolitan Board of Works). A more clever chemist never breathed; but one less capable of giving an engineer any practical assistance, in helping to apply practically the beautiful things he discovered, could not possibly be found. This little man ought to have died a millionaire, for he was one of the profoundest of chemists. Although he discovered things, however, he did not think he had ever explained any of his processes to him as an engineer. The process to which Mr. Carpenter had referred enabled a determination of the sulphur to be made in a few minutes, compared with the twenty-four hours taken with the standard test. It was Mr. Keates who had pointed out in evidence on one of the parliamentary inquiries that gas companies manufacturing 5 or 6 million feet of gas were using vessels 40 feet square and 5 feet deep, containing lime. As soon as they got the lime into fine condition for taking out the sulphur, they immediately carried it away in barges and created a very great nuisance. It

was pointed out by Mr. Keates what was the effect—namely, that the whole volume of the bisulphide of carbon was insignificant, and that a mere wheelbarrow of lime would eliminate all sulphur necessary, whereas gas companies were employing tons of lime and were then throwing it all away immediately it became useful. The real meaning of this was that lime, once it took up sulphuretted hydrogen, abandoned it easily when carbonic acid was brought to the inlet of the purifier. Having got the purifier into a very efficient condition in which it was found that it lasted many months, the sulphur that had already accumulated was allowed to go out of the purifier, and gas engineers were very much surprised to discover that the gas which in the retort had 20 grains of sulphur had 200 grains in the purifier. They were destroying the very stuff which was useful, and of which Mr. Keates said a barrowful would do as much as a barge load was being used for. The result of the process referred to by Mr. Carpenter was that to-day it was possible to make sulphuric acid of a purity which was not obtained by the sulphur ores of Spain, which contained arsenic. Gas sulphur contained no arsenic, and made the most beautiful sulphuric acid in the world. This was arrived at by three consecutive stages of purification. First, lime which took out carbonic acid. The next stage of the purification contained the stuff which was most foul, stunk abominably, and created a nuisance over the whole neighbourhood, and which was all colours—black, blue, and green; these being responsible for it receiving its former name of "Blue Billy." Finally, there must be the oxide purifiers, taking out sulphuretted hydrogen. Thus a very economical result had been obtained; and Mr. Gill could tell of the manner in which the purifiers had been worked on the Jones system, though it had been disputed in that very room. The process had reduced the sulphur to below 6 grains per 100 cubic feet; and this seemed to be the irreducible minimum that divided Mr. Leicester Greville's chemistry and his (Mr. Jones's) engineering. Having got this far, the Act of Parliament was introduced to legislate on the matter. When one legislated that a man should not steal a horse, however, there should at least be a policeman to see that he did right. But the chemists never told the gas undertakings a word of how they were to purify their gas at all. They allowed them to use lime and saturate the whole neighbourhood with nuisance. This was their advice; and he defied Professor Clowes to say it was not so. The chemists never showed the way at all, but left the companies under all sorts of penalties day by day because they did not do something which the chemists could not tell them how to. Was not this a ridiculous position? Immediately, however, the penalties were taken away, they had Mr. Carpenter coming forward with the catalytic process; and since then considerable progress had been made. With regard to leather, he went into his country house 35 years ago in which there were some bookcases with leather flounces to keep the dust from the books. His predecessor apparently did not like gas; but he himself had gas put in within 3 feet of these ancient bookcases and this ancient leather, and it had burnt in this position for over 15 years. Then he added some bookcases with similar, but more modern, leather flounces. To-day this modern leather could be blown away, whereas the original leather that was there when he first went into the house was absolutely unaffected by the gas. Personally, he did not believe in the least in the experiments on leather, and the samples that had been exhibited that evening. He knew what experts could do, because he had been an expert himself.

Mr. W. J. A. Butterfield said he rather anticipated from the title of the paper that Professor Clowes was going to take them back to the lime machine of a century ago for removing sulphuretted hydrogen from gas, because it was important to remember that the sulphur compounds which had been spoken of represented only 1-18th or 1-20th of the sulphur initially in the crude gas. At any rate, through gas supply, whether the other sulphur compounds were removed or not, the vitiation of the atmosphere from the burning of coal was diminished to this extent. Coming to the point of the removal of sulphur compounds other than sulphuretted hydrogen from gas, seeing the title of the paper he had turned up a report from Mr. Robert Harris, the Engineer to the Great Central Gas Company at their Bow Common works, in which were described ten methods of dealing with sulphur impurities which he had tried fifty years ago. This report was dated Sept. 1, 1869; and the ten methods were briefly described as given below. It was well known why Mr. Harris did not get better results than 40 per cent. It was that he had not realized how the lime should be used, and he believed it was one of the original Gas Referees who first put in print how the lime should be used. This gentleman was unwise enough to take out a patent for the process. The result was that he lost his position as a Gas Referee, and practically precluded Gas Referees for all time from taking out any patent at all, even though it was merely for the protection of the manufacture of an article they wished to see was properly standardized. There was also another process by Mr. Vernon Harcourt, apart from the one which the President had mentioned, and of which he (the speaker) knew nothing; but possibly Mr. Jones remembered it. It was stated in a report dated January, 1872, that according to it a perforated metal wad was placed in the mouthpiece of each retort, and that it had been tried at the Westminster works of the Chartered Company during the months of July and August, 1871; "when it proved unworkable, in the opinion of Mr. Harcourt himself." He had referred to these methods as a matter of historical interest only. With regard to the effect of sulphur compounds when gas was used for illuminating purposes, since the introduction of the incandescent burner the amount of gas required to illuminate a room to a satisfactory extent was about 1-10th what it was before. Therefore, legislation with a view to keeping the sulphur compounds in the gas down to a minimum, which was necessary before the introduction of the incandescent burner, became ridiculous at the present time. It was a matter of degree, or of the proportion of sulphur dioxide in the air of the room which caused the effects shown in the samples of leather exhibited by Dr. Gordon Parker. In all cases where very harmful effects were seen, much more gas had been burnt than was necessary for the proper illumination of the cubic space in which these samples were exposed. He had given some figures as to the ratio of carbon dioxide to sulphur dioxide in a room properly illuminated by gas and at the same time ventilated to the ordinary factory standard, in lectures two or three years ago before the Institute of Chemistry; and the ratios there given showed that the sulphur dioxide from gas consumed for purely illuminating purposes was a negligible thing in a properly illuminated room. The harm of the sulphur compounds came in in the destruction of the burner fittings themselves, which, in the case of the inverted gas-burner, were exposed directly to the products of combustion in a concentrated form. He remembered that when a provincial gas company (whose name he need not mention) was seeking relief from the sulphur restriction some time ago, the fact that appeared to weigh with the Parliamentary Committee was an exhibition of two inverted burners, one of which had been used on a gas supply containing the full amount of sulphur compounds and the other one in which

Report by Mr. Robert Harris, dated Sept. 1, 1869, on
"Processes Experimented Upon, and Used, at the Works of the Great Central Gas Company for the Removal of Sulphur Compounds other than Sulphuretted Hydrogen from Gas."

Processes.	Results.
From October, 1864, to December, 1865, the whole of the coals used were picked over by men and boys, and every visible piece of pyrites picked out.	This did not have sufficient effect to warrant the expenditure on labour and waste of coal incurred.
November, 1864, to June, 1865—Some gas was experimented upon by passing it through a preparation of soda and lead, a material known as Dr. A. Smith's material.	The results obtained showed a diminution of about half the sulphur compound; but the difficulty of getting the material and in its operation prevented its being used on an extended scale.
January, 1865.—Mixed slaked lime with coal in retorts.	A very little good effected not worth consideration.
February to April, 1865.—Treated gas, first experimentally and afterwards largely by passing it through red-hot tubes in conjunction with steam—a process suggested by Mr. Lewis Thomson.	Experimentally, nearly the whole of the sulphur compounds were removed without difficulty. When in practical operation the decomposition of the gas occasioned such a deposit of soot in the pipes as to necessitate the abandonment of the process.
In 1865.—Various changes were tried in the manufacture, shortening charges, reducing carbonizing temperature, varying scrubbing operations, &c., &c.	Not any results produced of sufficient importance to induce any permanent change of system.
July, 1865.—Washed gas with tar.	Not any good.
October, 1865.—Used soda waste.	Not any good.
In July, 1866, used tar and pitch in purifiers.	Not any good.
During last three months of 1866 passed gas on a large scale through red-hot pipes charged with various materials.	The removal of the sulphur was to the extent of about one-third; but the difficulty of heating the tubes and repurifying the gas was so great that the process could not be practically worked.
During latter part of 1866 experimented on the effect of dry lime used in various ways.	The passing the gas through lime first and afterwards through oxide of iron removed about 40 per cent. of the sulphur compounds.

This process was put into practical operation in January, 1867, and has been continued ever since, with results that bear out the experiments first made.

the sulphur compounds had been removed; and the difference in the corrosion was very marked. The Committee, he believed, from the questions which were put to him as a witness, were disposed to impose any restriction on the gas company which they could have complied with without the use of lime. At that date, some eight years ago, Mr. Carpenter's process was not known; and there was no other process which appreciably reduced the sulphur compounds without the use of lime. If the Committee had had Mr. Carpenter's process before them, he believed they would not have removed the restriction altogether.

Dr. SAMUEL RIDEAL said he had visited Continental countries prior to 1904 in connection with the sulphur question, and was astonished to find that in Brussels, Berlin, Vienna, and Paris the problem had not been before the authorities in the way it had been in England for the last forty or fifty years. In Berlin, it seemed to be quite unknown. There was no provision at all for the removal of sulphur from coal gas by lime. In Vienna, the same sort of thing happened; the problem had not been dealt with at all. Yet in this country there had been numerous fights for a number of years; and, as Professor Clowes had said, he tried to remove the small percentage of the residual sulphur in the gas—namely, 40 grains as a maximum (out of 400) left in prior to the sulphur clauses being abolished. This was extremely small compared with the amount that was left in crude coal burnt in the domestic grate, which had never yet been subject to any legislation; and it showed that the efforts of chemists had been directed to a wrong purpose. It shou'd not be forgotten that, in looking upon the purification of the air of a room, it must be regarded as a whole; and they must not legislate for the removal of the sulphur from gas or the sulphur in paraffin used in oil-lamps while the sulphur in the grate was many times more. These points were brought out clearly in 1903 or 1904. Dr. Parker, in his samples, had brought forward evidence as to the injuriousness of sulphur in a room, not on health but upon leather; and they had heard Mr. Jones tell them about his library leather. Dr. Parker was an expert in leather and not an expert in sulphur; and the samples seemed to suggest how not to make leather to withstand ordinary town atmospheres. Had he intended to speak in the discussion, he would have brought some samples, not of leather but of a metal that he exposed in the Old Kent Road outside workmen's dwellings during the time of the inquiry already referred to. These samples were all sorts of things, such as curtain rings, nickel plated spoons, silver foil, and fancy articles. Some were exposed outside the workmen's dwellings and some inside. Inside two sets of experiments were carried out—namely, in a room in which the gas had not been purified by means of lime, and in a room for which the gas had been purified—and it was found that the effect on the metals was more pronounced in the outside air than in the air of the rooms in which the two kinds of gas were being burnt. These specimens showed conclusively that the injurious effect upon the metal was due to the action of sulphuretted hydrogen and not to sulphuric acid. The silver articles exposed outside the dwellings were blackened; and it was known that the blackening of silver was due to sulphuretted hydrogen, which in this case had been produced in the air by the incomplete combustion of coal in domestic grates. Blackening of silver did not take place from sulphuric acid; and as sulphuretted hydrogen was always removed by the gas companies, it was clear that this was not the cause of any injurious effect inside rooms.

The CHAIRMAN, speaking as a user of gas and a chemist, said he could not help thinking that, although he agreed with Mr. Keates that precautions were taken so that there was no sulphuretted hydrogen in the gas, nevertheless, under certain conditions of combustion, sulphuretted hydrogen was produced—in fact, he was sure it was, because silver articles in his house had been blackened under conditions which had been proved to be due to the gas and nothing else. Mr. Harry Jones had spoken of the presence of arsenic in sulphuric acid made from pyrites; but he believed there was also arsenic in sulphuric acid made from recovered sulphur.

Mr. HARRY JONES said there was arsenic everywhere.

Professor CLOWES said that it did not seem to him that any point had been raised in the discussion which required reply from him. He was very pleased to meet Mr. Harry Jones again, for they had always been good friends, and he knew that he had always believed thoroughly in pure gas.

A hearty vote of thanks was accorded to Professor Clowes.

Relative Safety of Gas Lighting.

According to the "American Gas Institute News," the Fire Insurance Commission of Texas recently issued a report covering the period from Dec. 10, 1910, to April 19, 1915. In this report are given the sources of fires. These are:

Traceable to gas	908
Traceable to electric current	2,447
Traceable to gasoline and kerosene	2,492
Traceable to coal and wood stoves directly	2,749
Traceable to flues	3,006
Traceable to ashes	940

Illuminating Engineering Society.—The annual meeting of the Society takes place to-day, at the Royal Society of Arts. After the formal business, there will be a discussion on a report to be presented by the Research Committee.

EVAPORATION OF NAPHTHALENE IN DRY AND IN MOIST COAL GAS.

At the meeting of the London Section of the Society of Chemical Industry at Burlington House on Monday of last week, one of the papers contributed was by Mr. J. S. G. THOMAS, B.Sc., A.R.C.S., bearing the above title. The paper was much on the lines of the communication that appeared in the "JOURNAL" for Dec. 28 last, pp. 701-703.

The author remarked that previous work on the evaporation of naphthalene in dry coal gas, by Allen and Schlumberger, yielded results in practical agreement over the range from 30° to 50° C., whereas over the important range of temperature from 0° to 30° C., the values obtained by Allen were considerably higher than those obtained by Schlumberger. As a preliminary to an investigation into the effect of various vapours upon the saturation naphthalene content of coal gas which the author was requested to undertake by Mr. Charles Carpenter, D.Sc., the saturation naphthalene content of dry coal gas has been determined by the author, and the effect of water vapour upon the saturation content also investigated. Throughout the range from 0° to 60° C., the author obtained results in practical agreement with those of Schlumberger in the case of dry coal gas. In the case of moist coal gas between 0° and 30° C. he had found that the saturation vapour pressure of naphthalene was less than that in dry coal gas; the ratio of the saturation naphthalene content of moist coal gas to the saturation naphthalene content of dry coal gas approaching continuously more nearly to a ratio of equality as the temperature was raised from 0° to 30° C. Above 30° C., the saturation naphthalene content of moist gas was found to be slightly greater than the saturation naphthalene content of dry gas. The author sought to explain these results on the basis of the condensation of a skin of water upon the naphthalene in the case of moist gas; and theoretical considerations were advanced showing that this theory was in qualitative agreement with the experimental results.

DISCUSSION.

The CHAIRMAN expressed the indebtedness of the section to the President and his staff for the very valuable work they were carrying out. He believed this paper was only one of many that might be expected in better times from the South Metropolitan Gas Company's staff.

Mr. W. J. A. BUTTERFIELD congratulated the author on the valuable work that he was carrying out, and the South Metropolitan Company for the way in which they were giving the lead to the gas companies in the kingdom in conducting such research work at their laboratories. One point which he would like explained was whether the author, in referring to 100 cubic feet of gas, meant 100 cubic feet of dry gas *plus* 1 or 2 per cent. of moisture, or 100 cubic feet of moist gas.

Mr. CHARLES CARPENTER, D.Sc., said that as Mr. Jones had asked "what is the good of all these things" [laughter], he would like to say that there was a very great deal of good in it, and a very great deal of practical good. Perhaps he could best explain it by relating some of the circumstances which induced Mr. Thomas to undertake the work. An ordinary supplier of gas had two bugbears with which to contend. One was the sulphur compounds, the other the naphthalene, which was so very apt to cause trouble in winter by crystallizing on the service pipes. As an example of the manner in which work of this kind was carried out, and the empirical way of doing things, the average gas engineer looked forward to carrying the naphthalene in the gas, and thus preventing its deposition; and he was led to this idea by seeing the naphthalene, in the form of candles, burning in the Albo-Carbon gas light, as some of them might remember in the old days of the Aquarium. He was impressed with the enormous effect of this from the light point of view, and endeavoured to keep the naphthalene in the gas, so that, in burning it, the illuminating benefit would be obtained. If one calculated the heating value of the amount of naphthalene sufficient to stop up the services, it would be found that, from the point of view of calorific value and of light given, the value of the amount of naphthalene was absolutely negligible, both as a source of light and as a source of heat. With regard to the basis upon which they had been hitherto relying in the experimental work of Allen, it had been shown by Mr. Thomas that the figure given by Allen was double for ordinary temperatures that given by Schlumberger and Thomas; and after the South Metropolitan staff looked into the question of naphthalene removal, they came to the conclusion, on the work of Allen, that if the naphthalene could be cut down to 10 or 12 grains they would be absolutely immune from trouble in the distribution of gas. Although, however, the naphthalene content was cut down, the trouble, instead of getting less, got greater; and at one works which was connected to a gasholder by a main 2 miles long, the whole of the gas passed into the main was perfectly free from naphthalene, whereas the actual content of naphthalene at the outlet was something like 7 or 8 grains. This went on for two years; and on Allen's figures it was impossible to explain why it was. It seemed, however, that the explanation of the difficulty was that Allen's figures were wrong. Mr. Thomas looked into it, and made his valuable experiments which proved what had actually been found in practice—namely, that

the amount of naphthalene carried was something like half, or less than that, of the figure they were led to accept by Allen. This indicated the importance of getting at the bottom of these things; and the result of the work that Mr. Thomas had done was that it was necessary to have as a standard, not a figure of 10 or 12 grains, but something like 2 or 3 grains, so as to be on the safe side. This had been found the case in practice, and had been experimentally proved by Mr. Thomas.

Mr. THOMAS, in reply to Mr. Butterfield's question, said that when he mentioned 100 cubic feet he referred to dry gas without any water. He thanked Mr. Carpenter for his very kind remarks; but it was the fact that Mr. Carpenter throughout the whole of the investigation had inspired the work with his continued interest in it and suggestions, and he (Mr. Thomas) could only tell the members of the Society how much of the value of the work was due to Mr. Carpenter's inspiration.

A hearty vote of thanks was accorded to Mr. Thomas.

ENGINEERING AND SCIENTIFIC RESEARCH.

The very considerable attention which has been paid since the beginning of the war to the necessity for reforming and co-ordinating our national system of education and scientific research in relation to engineering, received a further impetus at a conference of engineers called by the Society of Engineers on Monday of last week. Professor J. A. FLEMING, F.R.S., opened a debate in which he indicated certain necessary improvements and requirements in regard to education, the relation of scientific research to engineering, industrial co-operative research, and the position of the engineering institutions in relation to schemes for assisting industrial research.

All these questions have a very close relation both in regard to the manufacture of gas-making machinery and also to actual gas manufacture; and to lead off on what may be termed the practical side of the many problems involved, it may perhaps be well to refer to the progress which is being made by the scheme formulated during last autumn by the Manchester Engineers' Club. The proposal was to form an Association of a non-trading and non-interference-with-prices basis, comprising British manufacturing concerns in all branches of engineering; the aim being to include every such concern, and to have a constitution giving the Association a legal status framed on broad principles and possessing an efficient and energetic management. Such an Association it was felt would speak with a powerful collective voice in matters with which Parliament was concerned, would assist the Government in questions connected with industry and commerce, and would be entitled to representation on the governing bodies of Universities and Technical Colleges. The scheme is for the work of the Association to be directed by a Council through the general manager; standing committees being appointed to deal with the following departments: (1) General purposes, (2) intelligence, (3) production, (4) inventions and patents, (5) publicity, (6) finance, (7) education and research, (8) parliamentary. Considerable progress has been made with the scheme; and it is evident that the large manufacturing firms realize that, notwithstanding the existing Associations and Societies, a comprehensive Association of this kind is absolutely necessary in the interests of engineering industry of all kinds. A Council for the organization of British engineering industry had been formed as a commencement, and all the largest firms in the immediate Manchester district had joined. This being so, those responsible for the movement were now going to London and the North-East Coast and Midlands to ask engineering firms to co-operate. At present 200 firms had joined, including 121 in the Manchester district.

Dealing with the educational and research problems, Professor Fleming laid great value upon the compulsory attendance of lads after leaving board schools at a technical continuation school. Assuming that a lad of 14 or 15 years is taken on at an engineering works, it should not be optional, he thought, whether he attended a continuation technical school. He should be compelled to do so, till he was 17 or 18 years of age, as in Germany. To a large extent, of course, this followed on the scheme of technical education which the Gas Light and Coke Company has had in force for their boys for some years now; and the value of it has become so apparent that it should secure considerable support for this suggestion of Professor Fleming's. To the training of young men of higher social rank who have been to public schools, there still existed the old differences of opinion as to whether works training should be sandwiched in with college training or not; but practical engineers had satisfied themselves that a college student coming direct into the works from the college laboratory had an absolute lack of knowledge of what may be termed the economics of manufacture, and that, with a view to giving the students a better knowledge of the cost of manufacture, the "sandwich" system had many merits.

On the general question of the relation of scientific research to engineering, there also seemed to exist many ideas as to the best way to go to work in order to obtain a proper development of power. Professor Fleming held very strongly that such research institutions as the Cavendish Laboratory, Cambridge, or the Royal Institution, London, should be strengthened; but that when it came to such work as the accurate determination of constants and data concerning materials and structures, accurate gauges and measuring tools, researches upon these could only be carried out in an institution like the National Physical Laboratory. The present facilities, however, at Teddington were, he thought, totally inadequate, especially in regard to metallurgical research work on a large scale. Such a laboratory should be provided with full-sized smelting and refining furnaces by coke, gas, &c.; and, owing to the expense involved, he suggested that manufacturers would be well to undertake industrial co-operative research in such laboratories, sharing the expense and keeping the results to themselves.

This question of large-scale experimental work was exercising the minds of manufacturers not a little; and a suggestion by Professor Miles Walker, of Manchester, might help. If it were not possible to equip laboratories with full-sized plant, the manufacturers should hire-out from the Universities and Technical Colleges assistants with testing apparatus who would carry out the researches on the manufacturers' own works. This principle could be applied not only to co-operative research, but small manufacturers could benefit by it, as, indeed, had already been done in one or two cases in the Manchester district. In this matter of research, so vital to the maintenance of trade, there was not very long ago a feeling that all the initiative should come from the Government. But this appeared to be dying-out—the view now being very widely held that we should not try to model our ideas too much on the German system, but that we should follow the national characteristic of private enterprise taking the initiative and leaving Government assistance to come later.

It seemed difficult to attend any meeting at which chemistry was discussed nowadays without finding the chemical industry held up to ridicule; and the conference on Monday was not an exception to the rule. Colonel C. E. Cassal referred to chemists in this country as a hopelessly disorganized body, not to be compared for a moment with engineers in their capacity for managing their own affairs. Chemical associations had never been to that industry what the Institution of Civil Engineers, for instance, had been to civil engineering; and until chemical people had become less narrow-minded and more ready to absorb other people's ideas in addition to their own, he was afraid this country would continue to be greatly in the background from this point of view. There was a very close connection between the engineer and the chemist, both of whom could be mutually advantageous to each other; and yet in this country the number of men who were capable of dealing with problems involving both chemistry and engineering could be numbered on the fingers of one hand. At the same time the only superiority of the Germans was the faculty which they had for plodding. The chemical profession in this country was divided roughly into two camps—the schoolmaster and the professional chemist. The former was wrapped up in his "schoolmastering," while the works chemist was absolutely outside the circle of the schoolmaster; and until something was done to alter this position, they would never get out of the difficulties now being encountered. One necessary reform in regard to the chemical industry was in our patent laws; and this was responsible for the unsuccessful attempts to work dyes in this country. We had allowed the Teutons to come here and take out patents, the specifications of which it was impossible to use for the simple reason that our system had allowed the Germans to leave out of their specifications the essential points necessary to the working of the patents. Our patent laws should be amended so that an absolutely complete specification was insisted upon.

Another matter which was criticized by Professor Fleming somewhat forcibly was the position of the engineering institutions in relation to schemes for assisting industrial research. The present policy of the Government and of the Board of Education, he said, seemed to be the creation of fresh Committees and Boards; while the existing learned and technical institutions were set on one side. There had recently been appointed Committees to safeguard the commercial interests of various trades; and the Royal Society recently called a conference of about 25 of the chief scientific and technical societies when it was decided to form a Board to advise the Government on any branch of scientific inquiry which might be brought before it. The result of all this must be to diminish rather than increase the very organization and co-ordination required; and he argued that engineering institutions and societies should take a live part in guiding the fortunes of the industries that they represented, and not be reduced to the nature of mere paper-reading and discussion societies. It should be pointed out, however, that in many cases, at any rate, the engineering and scientific societies often have been asked to appoint representatives on the committees dealing with their particular industries. Professor Fleming's complaint was that the institutions are not officially undertaking the work in question.

Chemical Society's "Enemy Members."—An extraordinary general meeting of the Chemical Society will be held on Thursday of this week, at Burlington House, "to consider the question of the removal of the names of nine alien enemies from the list of honorary and foreign members of the Society."

Mechanical Handling and Storing of Material.—We have received from Messrs. Crosby Lockwood and Son, of Stationers' Hall Court, E.C., and shall take an early opportunity of reviewing, a book entitled the "Mechanical Handling and Storing of Material," by George F. Zimmer, Assoc.M.Inst.C.E. The work, which runs to 750 pages, and contains over 1000 illustrations, is published at a cash price of 42s. net. It is a treatise on the handling and storing of material such as grain, coal, ore, timber, &c., by automatic or semi-automatic machinery, together with the various accessories used in the manipulation of such plant.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Board of Trade Gas Economy Circular.

SIR,—The Board of Trade circular dealing with the curtailment of the consumption of gas and electricity has been addressed to the secretaries of gas companies, yet the secretaries are denied *entrée* to the organization claiming the right to the consideration of such matters. The circular is a most important one; and it appears to me to be essentially one calling for immediate collective action by a representative body such as has lately been advocated in the "JOURNAL."

May I, in connection with the Board of Trade circular, mention three points which are probably already in your mind:

Statutory gas companies should receive treatment equal to railway companies. The latter have been guaranteed their 1913-14 receipts by reason of the increased cost of coal.

Any department of the Civil Service *thinking* of possible waste of artificial light when its Government *is* an actual waster of daylight, and consequently artificial light and coal, is like comic opera.

Through staff shortage, undertakings have not the inspectors at their disposal to engage in inquiry into the uses to which domestic lighting is put, neither have they sufficient clerical labour to deal with calculations and statistics which such work would involve.

May 5, 1916. NOT A MEMBER OF THE INSTITUTION.

Air Supply to Retort-Furnaces.

SIR,—As one who is very keenly interested in the above subject, I beg to take exception to the letter, under the above heading, in the "JOURNAL" for the 25th ult. (p. 182).

Your correspondent asks, "Why mention the primary air only?" and proceeds to point out that "the secondary air is subject to similar fluctuations, *when caused by variations of chimney draught*." The proviso (printed in italics) might easily be overlooked by the casual reader, and would lead him to very erroneous conclusions. So far as it goes, the statement is quite correct; but the reader should bear in mind that the fluctuations in primary air are due not so much to variations of chimney draught, as to variations in the resistance offered by the fire to the passage of the air. This resistance is affected by the three following factors:

(*a*) Depth of fuel in furnace.
(*b*) Size and nature of furnace.
(*c*) Amount and nature of clinker in the fire.

The extent to which these factors affect the primary-air supply naturally varies with the design of the furnace, the nature of the coal carbonized, and the attention given to feeding and clinkering the fires. If the area and capacity of the producer are on the small side, and especially if it is fed at long intervals, the variations due to changes in depth of fuel are very evident. Where mixtures of coals are used, it is apparent that the nature of the coke fed into the producer may vary almost hourly, and, as some cokes require two or three times as much primary air opening as others, it would be impossible to maintain a constant supply of primary air except by automatic regulation of the primary air itself. No amount of chimney draught regulation would do this, even if one had a separate chimney to each bed. For the sake of argument, let us take the latter case—*i.e.*, one chimney to each bed—which, although very rare, would be most favourable to chimney draught regulation. When, owing to any of the factors (*a*, *b*, or *c*), the resistance of the fire is above the normal, the primary-air supply is reduced. This will cause the vacuum on the top of the fire to increase, and will cause an excessive amount of secondary air to be drawn into the combustion chamber, and will also increase the vacuum at the entrance to the chimney. If, as is usual with chimney draught regulators, the regulator is designed to maintain a constant pull, it would proceed to reduce the pull, and so still further reduce the amount of primary air passing through the already choked fire. Under such circumstances, it is evident that the proper proportions of primary and secondary air cannot be maintained, and the amount of primary air admitted must be subject to even greater variations than if the chimney draught were not governed at all. With such variations in the *amount* of primary air admitted, and in the *proportion* of primary and secondary air, it follows that the heat generated in the combustion chamber must vary considerably, and must, at times, be far in excess of the heat required. It is this variation which causes not only periodical overheating, but periodical expansion and contraction of the brickwork and retorts, and so shortens the life of the setting. To try to control a range of settings by one chimney draught regulator would be even worse, because some settings must naturally offer less resistance than others, as the conditions of the fires vary; and the tendency would be to increase the amount of air passing through the settings offering least resistance, and to reduce the amount passing through the remainder.

To my mind there is no doubt about it that the ideal thing is to govern both the primary and secondary air inlets, so that they pass a constant amount of air, whatever variations may take place in either the chimney draught or the resistance of the fire. This is being done in a large number of works with good results. In cases where the regenerators are old, and the secondary air slides are too wide open to lend themselves to automatic control, a considerable saving of fuel and increased life of the setting can be obtained by governing the primary air only, as it is here where the biggest variations occur. In such cases, the saving can be increased if the main damper is set periodically to a sensitive gauge, to compensate for changes in the weather. I believe that, in such cases—*i.e.*, where the primary air inlets are governed—a suitable chimney draught regulator would have a good effect. The automatic air regulator, of which I am the patentee, can be arranged as a chimney draught regulator; but, as in the case of other chimney draught regulators, I could not recommend its adoption, except where the chimney draught is more than ample for ordinary use.

Here I come to the point where I am most at variance with your correspondent. Speaking of automatic air regulators, he says:

> So far as we are aware, they have always taken the form of restricting the area only. This has had the effect of increasing the vacuum, which the pull of the chimney tends to cause; and the result is that approximately the same amount of air is drawn at a higher velocity through the smaller opening. A more serious result of this restriction of air inlet is the rapidity with which the gases are pulled through the setting, which not only tends to localize the heat, but causes serious damage to the brickwork and the retorts, by the cutting action of the hot gases which is set up thereby.

I am afraid that, in the above remarks, your correspondent betrays an utter lack of grasp of the principles governing the flow of gases through a retort-setting.

Let Q (cubic feet) be the volume of air passing through the setting per second which, with automatic regulators, your correspondent admits is practically constant.

Let A (square feet) be the area of the air passages or flues in the setting, which must be constant. [Do not confuse area of air inlet with the area of the flues in the setting.]

Let V = the velocity of the gases in feet per second.

Then by a simple law of the flow of gases, we have

$$Q = A\,V$$

$$\text{or } V = \frac{Q}{A}$$

Since A is constant and Q is admitted to be practically constant, V must be practically constant, and all this talk about the increased velocity of the gases passing through the setting, and its deleterious effects upon the brickwork, &c., falls to the ground.

The fact is, to take the primary air as an example, the regulator only commences to close when the resistance of the fire to the passage of the air has fallen below the normal, and when, otherwise, an excessive amount of air would be drawn in. When closing, it reduces the current of air, and, at the same time, offers that extra resistance to the passage of the air which has been temporarily lost elsewhere. The vacuum under the grate bars and on top of the fire certainly increases as the primary air slides close; but, before the regulator was caused to close by the reduction of the resistance of the fire, the vacuum on top of the fire must have been below the normal, owing to the extra amount of air being drawn through the furnace.

The regulators, therefore, maintain a more steady vacuum as well as a more steady rate of flow of the gases. If the air passes through the regulators at a constant pace, it follows that it must flow through the fire and settings at a constant pace, giving a better quality of producer gas and constant combustion, not to mention even heating.

The settings can, therefore, be worked with less damper to maintain the required heat, without any danger of those periods of overheating which occur in the ordinary way. The velocity of the gases is slower, and the settings last much longer. As a proof of this, the first settings to be fitted with these regulators were started-up in July, 1912. The regulators were fixed the following August. In the ordinary course, these settings should have been let-down for patching about March, 1914, whereas they have run right through until March this year (1916). Dr. Davidson and others have vouched for the enormous saving in fuel, which, I may say, has been well maintained.

The saving in clinkering should not be overlooked, as, owing to the reduced quantity of air and the reduced velocity and more constant flow of the same, not nearly so much clinker is formed. Fires which in the ordinary way will only go 24 hours without clinkering, will easily go 48 hours with the regulator.

Some engineers may find difficulty in adjusting the regulators at first; but I am convinced that we can now deliver the regulators in such a form that they will be just as simple to regulate as the old-fashioned slide. I have repeatedly had such regulators tested, and they have been found to maintain a constant stream of air within 2 or 3 per cent., with a variation of from half-a-tenth to three-tenths pull, whether the regulator was set to pass a small amount of air or was set to its full capacity.

Reverting to your correspondent's statement that the vacuum was increased by curtailing the primary-air inlet, the same thing would happen by closing, or partially closing, the ordinary air-slides, but no sane engineer would hesitate to cut-down the primary-air opening if he found that (say, through a change of coke) he was drawing in too much air.

No amount of regulation of either the chimney draught or the air inlets will prevent the drawing in of excessive air when the clinkering doors are open; but I think that the best way to overcome this difficulty is to have separate clinkering dampers, above or below the ordinary bed dampers—as are sometimes fixed by Messrs. R. Dempster and Sons, and possibly other firms. These dampers are closed when clinkering commences, and opened again when the operation is completed. The ordinary bed dampers are, therefore, not interfered with, and the waste of fuel is prevented. I cannot agree with your correspondent that this waste of fuel during clinkering necessarily causes overheating—in fact, the reverse is usually the case. The excessive amount of producer gas generated floods the combustion chamber, and so considerably checks the amount of secondary air admitted. The combustion is, therefore, very imperfect; most of the producer gas escaping unburnt. When we consider that, to burn 1 lb. of carbon to carbon monoxide, only about 4500 B.Th.U. are generated, as against about 14,500 B.Th.U. for the complete combustion, one would naturally expect a falling off in temperature when the clinkering doors are open.

Mr. Madden's idea of putting breeze on the fire may work in some cases with good results. All I can say is that, possibly owing to local circumstances, it did not pan-out well when we tried it, and we had to discontinue it. At the same time, I should be the last to disparage the idea on this account.

Paignton, May 3, 1916. T. BROOKE.

REGISTER OF PATENTS.

Producing Synthetic Ammonia.

BAMBACH, A., of Cologne.

No. 3175; Feb. 6, 1914.

This invention relates to a process of combining atmospheric nitrogen with metal and carbon and of decomposing the cyanides, cyanamides, and similar compounds thus formed into ammonia by means of saturated or superheated steam or water spray.

To bind the nitrogen of the air by means of metal salts– for instance, K_2CO_3, Na_2CO_3, &c.—in the presence of carbon and under the influence of high temperatures is already known, the patentee remarks; but processes based on such reaction have not so far been found sufficiently profitable for practical application. He claims: "A process of producing synthetic ammonia from nitro-carbon-metal compounds in gas-generators, consisting in adding suitable proportions of metal salts, oxides, hydroxides, or carbides in solid or liquid form to the carbonaceous generator charge for fixing the atmospheric nitrogen, and forming nitrogenous metal and carbon compounds, decomposing such compounds by the introduction of superheated steam under pressure or water spray directly into the combustion zone of the generator, together with the air, so that water gas and ammonia are formed and passed off simultaneously."

Radiants for Gas-Fires.

WILSON, W. A., of Armley, near Leeds.

No. 5119; April 3, 1915.

This invention relates to means for manufacturing radiants or "fuel" for use in gas-fires—the usual method being to make a radiant in two halves, which are joined together before being burnt in a kiln—a method that has its advantages in that roughness, ribs, projections, studs, or the like can be readily constructed or formed on the interior of the radiant. In other cases, the radiant has been made in one piece on one or more centre-pins. This gave a stronger construction, but did not enable studs to be formed on the inside; so that when roughness or any projection was desired it generally took the form of continuous ribs, as the withdrawing of the centre-pin did not break the continuity of the ribs. After considerable experiment, the patentee claims to have found that a radiant provided in the (preferably solid) back with studs, nipples, or pointed projections is more efficient than ribs; and he has also found that the highest efficiency is obtained with projections increasing in size as they project into the interior of the radiant and away from the burner. His present object, therefore, is to devise means to enable the construction of a radiant in one piece, without joints, having a construction such as to permit of "the construction of one or several columns of fuel in one piece, whether such radiant be straight or curved."

Gas Water-Heaters.

VALENTINE, H. S., of Glasgow.

No. 7356; May 17, 1915.

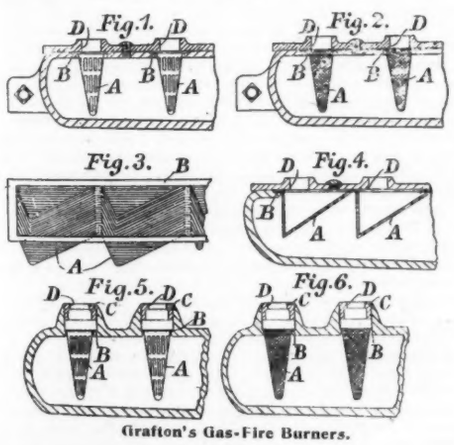
This invention is a modification of the heater described in patent No. 16,959 of 1914, which was an appliance adapted primarily to heat, by means of gas, the circulating boiler of an existing coal-consuming range. The object of the present invention is to apply similar methods to the heating of an independent boiler or circulator.

Gas-Fire Burners.

GRAFTON, W., of Glasgow.

No. 10,294; July 15, 1915.

This invention relating to burners for gas-fires has for its object to prevent them lighting-back, by providing (in immediate proximity to each nozzle) an apertured screen of non-spherical formation and tapering downwards from its widest part adjacent to the nozzle to the narrowest part remote from the nozzle—"there being no part of the screen between the ends which is wider than any part nearer the nozzle or narrower than any part more remote from the nozzle."



Grafton's Gas-Fire Burners.

Fig. 1 is a section showing one embodiment of the invention; fig. 2, a section of a further embodiment; fig. 3, a perspective view of a modified form of screen; fig. 4, a sectional view showing in position the screen illustrated in fig. 3; figs. 5 and 6 are sectional views of modified forms of burner.

There is fitted to the burner or each burner nozzle an apertured screen A, of perforated or slotted metal—*e.g.*, gauze, or non-metallic incombustible material such as steatite, magnesia, fire-clay, or the like—of such form as to allow free passage for air and gas mixture, but to prevent the passage of flame "even at the moment when the fire is being lighted or extinguished." The screen may be formed as a complete hollow cone or pyramid, or as a connected series of triangular prisms. In each case the screen is open at the base and closed at the apex, the cone or pyramid being inverted when in position—*i.e.*, tapering downwards, with the base slightly overturned at B to rest on a shoulder formed by countersinking the burner orifice. Alternatively, as in figs. 5 and 6, the screen may be fitted into the burner orifice and held there by a ferrule C closely fitted into the burner nozzle and formed with an outlet bounded by an internal flange D on the nozzle. In fig. 1, the outlets D are formed in a common plate secured to the body of the burner.

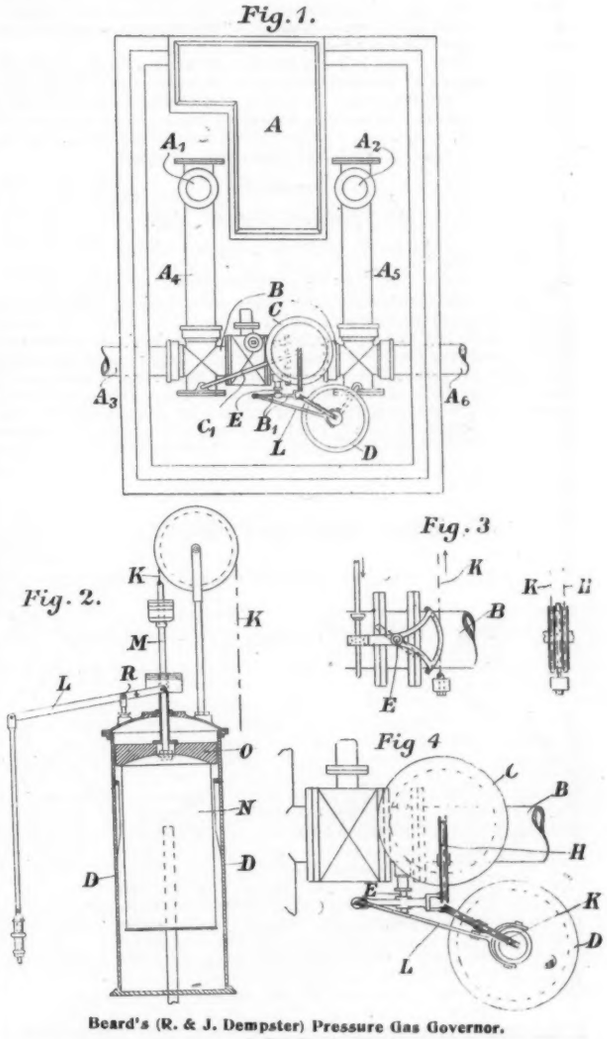
The patentee remarks: A screen of the form described presents a large area for passage of the mixture through the orifices or slots or meshes of the gauze or the like, but is also impenetrable to flame. With the use of such a screen, it is therefore practicable to aërate the mixture to any desired extent without risk of lighting-back.

Supplying Gas under Pressure.

R. & J. DEMPSTER, LIMITED, and BEARD, G. F. H., of Manchester.

No. 16,696; Nov. 26, 1915.

This invention relates to governing means employed in plants for supplying gas under pressure, wherein facilities are provided for by-passing the gas in order to keep high and low pressures in the mains within proper working limits. The governing means employed for the purpose consists of a pair of governors, one of which is in double or compound form—that is to say, the bell in it automatically becomes loaded when the governor acts as a high-pressure one, and becomes automatically reduced in load when the apparatus acts as a low-pressure governor.



Beard's (R. & J. Dempster) Pressure Gas Governor.

The illustration shows one form of plant suitable for delivering gas under pressure. Fig. 1 is a plan; fig. 2, a sectional elevation of the compound governor employed; fig. 3, a side view of a portion of fig. 4; and fig. 4, a plan of a portion of fig. 1, showing a pair of governors coupled-up to means for operating a single valve.

In fig. 1, A is the foundation for supporting an exhauster or other means for converting low into high pressure gas, and to which ex-

hauster the gas is supposed to be supplied from the inlet communication at A^1, and to pass through the exhauster to the outlet connection at A^2. During normal operations, the gas is assumed to pass from a gasholder, or source of supply, in connection with the mains A^8, A^4; and, after passing through the exhauster, to enter the main A^5 and pass into the main A^6, ready for use. When it is necessary for the pressures in the mains to be controlled or kept within proper limits by additional means, communication is opened up, through the pipe connection at B, between the mains A^3 and A^6.

The connection B is capable of being opened or closed by a wing-valve, operated through the spindle E and a quadrant lever through which the two bell governors C and D are coupled up. That is to say, the governor C is connected by a chain H passing over a wheel assumed to be freely mounted in position above the governor. The opposite end of the chain is connected to the crown of the bell of the governor—an ordinary one of suction type. The governor D—a compound one—is connected to the lever by a chain K passing round, and also by means of a connection L. The chain K is connected to a spindle or shaft M, suitably weighted with detachable weights, and attached to the crown of the bell N. In the position illustrated, the bell supports a weight device O, attached to a sleeve (carrying adjustable weights) pivoted to the part L, which is capable of moving about an axis R. When, however, the bell falls below a certain level, the weight O becomes supported by a projection or rim, and it thus becomes relieved of the weight or pressure device. When the bell falls, it moves the chain at K in the direction indicated by the arrow line in fig. 3; but when it rises sufficiently to raise the weight O, and therefore causes the connection to move in the opposite direction, the direction of movement is as indicated by the second arrow line in fig. 3. These two movements, being opposite in direction, but operating at opposite ends of the lever, have the effect of moving the wing valve in the same direction.

The operation is as follows: When the gas in the mains A^3 A^4, on the inlet side of the exhauster, tends to fall below a desired pressure, the consequent fall of the bell in the governor C operates the chain H, and therefore the quadrant end of the lever, with the result that the wing valve is opened, and the undesirable condition is thus rectified. In the case of the mains A^5 A^6, should the fall of pressure therein require controlling, the fall of the bell N will, through the chain K, cause the wing valve to be opened, while an excess of pressure in the mains, on lifting the bell, will cause it to engage the weight O and lift it from the supports, so that the governor becomes a "pressure governor," and also operates to open the wing valve.

The governors C and D being coupled-up as described, enable the desired results to be accomplished, added to which, the operation of a single valve "ensures greater possibility of success, in that the valve is not left unused for long periods, with the danger of failing to act, or acting faultily, on account of accumulated rust or the like, as in the ordinary case where a number of valves are employed."

Gas Stoves, Ovens, &c.

JACKS, T., of Ruthin, North Wales.

No. 3458; March 4, 1915.

This invention consists in fitting to the oven door or to the gas-tap (or else between them) devices which render it impossible to turn on the tap controlling the gas supply to the interior burners without first of all opening the door—"thereby preventing the imprisonment of gas within the oven caused by turning on the tap prior to opening the door." A pivoted weighted lever or catch is made to bear on the top edge or any portion of the door and on the edge of a tap handle controlling the interior burners. The lever cannot, therefore, be moved on its pivot until the door is opened to release the other end of it, when the lever can swing on its pivot to enable the tap handle to pass same when being turned on.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for May 3.]

Nos. 5871—6175.

ALLEY, E. S.—"System of laying pipes, &c., underground." No. 5909.

BLYTH, M. W.—"Removal and recovery of carbon dioxide from mixtures of inert gases with carbon dioxide." No. 5942.

CHRISTOPHER, J. E.—"Gas-cooling apparatus." No. 6087.

HAILWOOD, J.—"Apparatus for gas-firing, or a combination of gas-firing and coal-firing, steam-boiler, &c., furnaces." No. 6148.

HERSEY, S.—"Effecting intimate contact of liquids and gases." No. 6120.

KIRKHAM, HULETT, and CHANDLER.—See Hersey. No. 6120.

NASH, J. G.—"Gas-burners for smelting and heating." No. 5899.

NASH, J. G.—"Gas-burners for cooking and heating." No. 5900.

NASH, J. G.—"Gas-burners for lighting." No. 5901.

NASH, J. G.—"Gas-generators." No. 5902.

NEWTON, CHAMBERS, AND CO.—See Blyth. No. 5942.

SHAW, H. S. HELE.—"Pipe and cylinder flange joints." No. 6007.

STEIGER, E.—"Automatically turning lights on and off." No. 6031.

TINSLEY.—See Nash. Nos. 5899, 5900, 5901, and 5902.

TWELLS, A. H.—"Automatic temperature-controlling means for heaters, &c." No. 5887.

WALKER, G. H.—"Air and gas compressors." No. 5883.

Cost of the Public Lighting of Manchester.—According to the minutes of the Manchester Gas Committee, it is estimated that the cost of public lighting in the city for the year ending March 31 next will amount to £31,742. This figure was arrived at at a meeting of the Gas Committee on the 19th ult., when the estimates for the present financial year were reviewed and approved.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bill brought from the Commons, read the first time, and referred to the Examiners: Folkestone Gas.

Bill read a second time and committed: Gas Provisional Orders, Wakefield Corporation.

The Commons' amendments to the Burnley Corporation Bill were considered last Wednesday and agreed to.

HOUSE OF COMMONS.

The following further progress has been made with Bills:

Bill read a second time and committed: Local Government Provisional Orders (No. 2) Bill.

Bills read the third time, and passed: Burnley Corporation (with amendments), Folkestone Gas.

The Imperial Continental Gas Association Bill has been referred to the Unopposed Bills Committee.

A Bill to confirm a Provisional Order (Gas) of the Local Government Board of Ireland relating to Bangor was presented on Tuesday last week by Mr. T. W. Russell, read the first time, and referred to the Examiners.

The Municipal Savings Banks (War Loan Investment) Bill—the object of which was referred to in the "JOURNAL" for April 18, p. 122—has been withdrawn.

LEGAL INTELLIGENCE.

GAS MANTLE METALS—WRONGFUL USE OF NAMES AS DIRECTORS.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, May 5.

(*Before Mr. Justice* SARGANT.)

There were motions before the Court to-day for an injunction to restrain the use of the names of certain Directors of the Travancore Minerals Company, Limited, as being Directors of Nitrate of Thorium and By-Products, Limited.

Mr. GRANT, K.C. (with him Mr. STOKES), said he had to move on behalf of Sir John Prescott Hewett, for an injunction restraining the defendant (Mr. Walter Herbert Nockolds), his servants, and agents, until judgment or further order, from printing, publishing, issuing, or circulating, or causing to be permitted to be printed, published, issued, or circulated, any memorandum, prospectus, advertisement, circular, or other notice or document relating to a Company formed, or about to be formed, with the name of Nitrate of Thorium and By-Products, Limited, or any other Company, now or hereafter to be formed, containing any statement that plaintiff had consented to join the Board of Directors of any such Company, or other statement to the like effect, or so framed as to represent or lead to the belief that the plaintiff had consented to join any such Board.

Mr. ISRAEL (for the defendant) said it might save time if he were allowed to interpose.

Mr. GRANT replied that he must open the motion in his own way, as the defendant had committed a most unwarrantable act. The facts were briefly that at the beginning of the war there was a Company in existence called the Travancore Minerals Company, Limited, which had a concession from the Government of India for the sale of monazite sand. The Company was under German control; and the Secretary of State for India very properly decided that this state of things should not be allowed to continue, and changes in the constitution of the Company were made. In order to see that the British public were protected, Sir John Hewett was put on the Board, and made Chairman by direction of the Secretary of State. The defendant was minded to obtain an option from the Company for the purchase of a portion of their products; and when Sir John Hewett left England at the end of last year, negotiations were in progress. Sir John came back in March; and he found statements in the Press reflecting on him, which arose from a memorandum that was being hawked about in the City on which his name appeared as a Director. Sir John had never consented to become a Director, or to the document being issued. The position now taken up by the defendant was that he had made a blunder—plaintiff did not charge him with dishonesty, but it was a most unwarrantable act to use a person's name without his permission—and he was willing to treat the motion as the trial of the action, to submit to a perpetual injunction, and to pay the costs.

Mr. BISCHOFF said he had a similar motion, in an action instituted by Mr. Hugo Hirst, another Director of the Company, whose name was also mentioned as a Director of the new Company. He (Counsel) associated himself entirely with everything Mr. Grant had said; and he understood his learned friend, Mr. Israel, adopted the same attitude in this case. There was also a third gentleman, Sir David Yule, who was in India when the new Company was about to be formed, and who arrived in England only two days ago. He had filed an affidavit from which it appeared that he took no part whatever in the issue of the memorandum by the defendant. He said he acquired shares in the Travancore Minerals Company on Feb. 6, 1915; and at the request of Sir John Hewett he intimated that he might not be unwilling to

become a Director of the Nitrate of Thorium Company, though he had never actually done so, nor had he approved the memorandum. Sir David Yule had not brought an action; but he was anxious that his position should be made clear.

Mr. GRANT said it was a rather serious matter; but nothing further need be said, considering the position defendant took up. He would suggest that defendant should let the persons to whom the memorandum had been sent know the exact state of things.

Mr. ISRAEL remarked that he was somewhat surprised at the way in which the motion had been opened, after his statement; and therefore it was only justice to the defendant that he should indicate the precise facts. This was not a case of a promoter trying to obtain capital from the public by misrepresentation. It was an absolutely *bonâ fide* mistake, for which there was every justification, though one might have to pay for the mistake. The plaintiff in his own affidavit said the agreement contained a clause for securing that the number of Directors of the proposed new Company should be five, of whom two should be nominated by the Travancore Company, so long as such Company were the registered holders of shares in the new Company of a certain amount, and that one (who should be the Chairman) should be the Chairman for the time being appointed by the Secretary of State for India of the Board of Directors of the Travancore Company. Plaintiff further said that before the agreement had been completed the defendant had inquired who would probably act as the representative of the Travancore Company. "He was told, on my authority, that probably I would act as Chairman of the new Company, and that Mr. Hugo Hirst and Sir David Yule would probably be the nominees of the Travancore Company." It was an irresistible inference that, but for the article in the public Press, this action never would have been brought. As a matter of fact, the memorandum was sent to not more than a dozen people. It was marked "For private information only;" and it was done for the purpose of obtaining intending shareholders and communicating them to the Board of Trade. But, be this as it might, there was a mistake in not showing the memorandum to the plaintiff; and for this the defendant apologized.

His LORDSHIP said a person should have a definite acceptance before making any statement.

Mr. ISRAEL replied that he entirely agreed; but people sometimes acted on assumption. The defendant thought these persons would become Directors; and, in fact, that was one of the safeguards. He might have acted unwisely, but nothing more than this. The defendant did not wish to issue any more copies of the memorandum.

His LORDSHIP: Do I understand that what you say with regard to the two plaintiffs applies also to Sir David Yule?

Mr. ISRAEL: Certainly.

His LORDSHIP: It is a satisfactory end of the litigation. It may well be that the defendant made an honest mistake in the sense that he was too sanguine and spoke of things which were to happen as if they had happened. But I can quite understand that any person may very well be aggrieved at his name being put forward as a Director of a company, however probable it may be that he may ultimately be one, when, in fact, he has not consented to become one. There may be all kinds and conditions of precautions which have to be complied with before it is right and proper that a statement should be made; and persons may often find themselves in grave difficulty if suddenly surprised with a definite statement which can only be problematical.

PATENTS TO EMPLOY TOWN GAS:
ITS USE IN RESTORING THE CHEMICAL ACTIVITY OF METALS.

A group of patents, in which the determining factor is the town gas supply, occupied, on Friday, the Patents Court which is dealing with the patents of alien enemies.

An English inventor, Mr. Howard Lane, of the Laboratory, Ashford, Middlesex, petitioned to have three of his patents suspended in his own favour, as the patents of alien enemies. He had disposed of them in pre-war days to a German Company, the Internationale Wasserstoff Aktien-Gesellschaft; and his Counsel stated that the Company had been bought up by a Berlin Company interested in pushing a rival gas-making process. They and Mr. Lane had come to loggerheads; and there were cross-actions pending in the Chancery Division in respect of his invention when the war broke out.

Mr. Lane's invention is for the making of pure hydrogen gas through two phases: (*a*) The passing of steam, in retorts, over hot metal, which generates hydrogen gas (duly stored in a holder), but produces oxidation of the metal; and (*b*) the passing over the metal, at the same temperature, of gas from the town supply, which revivifies the metal, and restores it at once to chemical activity. Thereupon the steam process may be repeated for the evolution of other hydrogen gas. These two processes are continued alternately, and regulated by stopcocks in the pipes which are led into the transformer furnace, containing the retorts. Mr. Lane states that any ordinary gas will serve for the revivifying process—coal gas, water gas, or producer gas generated from coal, coke, or other carbonaceous fuel—and explains the oxidation and de-oxidation, under similar conditions, as due to the use of an excess of steam in the one instance and an excess of reducing gas in the other, the greater density and chemical effect of the gas employed to revive the metal being also probably a factor.

The inventor asked for a licence from the Board of Trade to use, and manufacture under, his own patents—Nos. 10,356 of 1903, 17,591 of 1909, and 11,878 of 1910—because he is in communication with the Admiralty to supply them with his gas-making plant for the inflation of airships and war-balloons. The Government have already employed his process at Aldershot. There are numerous commercial uses for hydrogen gas. One size of his gas-producing plant, he added, would make 7000 cubic feet an hour.

The Controller of Patents (Mr. Temple Franks) said there was evidently a public demand in this country for Mr. Lane's valuable process; and he should recommend the Board of Trade to grant him a licence to manufacture under the patents.

MISCELLANEOUS NEWS.

THE "WANDLE'S" NORTH SEA FIGHT.

Wandsworth Gas Company Directors' Tribute to British Pluck.

As last week's "JOURNAL" was being got ready for press, news came to hand, and was briefly recorded, that the s.s. "Wandle," belonging to the Wandsworth, Wimbledon, and Epsom District Gas Company, while on her way to London loaded with some 1250 tons of gas coal, fell in, on the previous Saturday, with a German submarine. Happily (unlike some other boats which the submarine had met with), the "Wandle" was armed in her stern with a gun for self-defence; and with this one means of protection, the Captain and crew put up, against a formidable antagonist, a gallant fight, the result of which was to prove that a steam-collier with a British crew, engaged on a peaceful errand, may be more than a match for a war-equipped submarine scouring the seas with the deliberate object of spreading death and destruction around. After an encounter lasting for something like three-quarters of an hour, the enemy vessel was fought off; and there is good reason for entertaining the hope she was sunk. From a fight with such a foe, the "Wandle" could not hope to issue unscathed; and unhappily one of the crew sustained several bad shrapnel wounds, besides which there was some damage to the ship.

The "Wandle" returned to the Tyne for temporary repairs; and these accomplished, the journey was resumed—the Thames being reached on Wednesday night. What riverside people and Londoners in general thought of the exploit was shown by the enthusiastic reception accorded to Captain and crew last Thursday, when, on the midday tide, the vessel was taken up the Thames to Wandsworth. Cheering crowds had collected at every point of vantage; and their efforts to give adequate expression to their feelings were powerfully seconded by the shrieks of innumerable sirens and hooters, the sounding of whistles and buzzers, and other instruments of noise. Naturally, Wandsworth itself was *en fête;* and when the men came ashore, there was a rousing scene. Everybody in the neighbourhood, and many from afar, had assembled at the gas-works to give honour where honour was due. Through the dense throng, Captain Mastin and the gunners were carried shoulder high to a trolley, which, converted into a platform, was to be the scene of a generous function—a presentation to Captain, officers, and crew, "in recognition of their display of courage." On the platform were Mr. Harry E. Jones (the Chairman) and other Directors of the Company, together with Field-Marshal Sir Evelyn Wood, and Alderman A. D. Dawnay, the Mayor of Wandsworth.

Mr. JONES remarked that they had gathered together for an important purpose—to do honour to British pluck, British perseverance in the face of danger, and British nerve. It had been hoped to have present Mr. Lloyd George, who took great interest in the presentation; but he had been unable to get away from the House of Commons. Mr. Lloyd George was very proud, as all of them were, to think that a humble little merchant vessel, manned by a crew having stout British hearts, should have shaken off a fiend like one of these submarines, which were out for murder and destruction without giving anyone a chance. This was a new form of fighting to English people; and they must do their best to put an end to it. On this occasion, through the bravery of the Captain and crew of the "Wandle," the submarine was deprived of its prey; for it was, at the time, holding-up a vessel which had not a gun mounted to enable it to fire a shot in self-defence. Captain Mastin not only preserved his own honour and his own prestige, but he preserved the property of the Company and of the owners of the other boat and those who had cargo in it. They owed him the greatest possible debt of gratitude. The Directors were proud of having such men as the Captain and crew of the "Wandle" in their service. They believed there were plenty more of them, who only wanted the opportunity to do precisely the same thing. And they believed that the man with a brave heart who would strike a blow for his country would also strike a blow for his employer. This was the sort of man they wanted to encourage. He was going to ask Field-Marshal Sir Evelyn Wood, the oldest Field-Marshal in this country, and a former Director of the Company, to make, on behalf of the Board, the presentation to Captain Mastin of a cheque for £250, of which they would like to see him appropriate £50 for himself, and divide the rest with his crew and the gunners. "Captain Mastin," concluded Mr. Jones, "to-day the Empire, and Europe as well, resounds with the story of your courage and prowess. This deed of yours in the North Sea will live in the history of your country and the records of your class of brave English seaman for all time. The unboastful terms in which you describe the battle you fought for your country and Company show the simple courage of a modest, bold, and capable officer; and they will be recorded on the minutes of the Company, so as to be handed down, as long as the undertaking exists, as an example of what brave English seamen will do when called upon." [Cheers.]

Sir EVELYN WOOD, in making the presentation, said the war had shown that courage was not confined to one class of the British nation. It had given him much pleasure to come and do honour to these men, whom he greatly respected. He rejoiced that men employed in a peaceful occupation should have been able to deal such a blow to the country's arch enemy. [He then handed the Captain the cheque, and shook hands with the gunner who fired the successful shot.]

Captain MASTIN, in acknowledgment, said he thanked the Company, on behalf of himself and the crew, for the gift, and also for having put the gun aboard. Had the gun not been there, the "Wandle," with her officers and crew, would have been in the North Sea now. He was happy to say the man who had been wounded was getting on well. They had done their duty, and would do it again.

Mr. JONES pointed out that Sir Henry Kimber, the late member for the division, with his friends, had raised a fund of £4400 for distribution among crews of vessels who succeeded in destroying submarines; and if the actual sinking of the submarine by the "Wandle" could

be traced, there would be the very substantial prize of £1100 for the crew. The pilots of Gravesend had written expressing their pride in the action of their fellow-townsmen; and this letter also would be entered on the minutes of the Company, and a copy of it handed to Captain Mastin.

The MAYOR, in proposing a vote of thanks to Sir Evelyn Wood, made a few remarks, in the course of which he declared his intention to have a silver medal struck to commemorate this wonderful piece of work, and he would ask Mr. Jones to come to the Town Hall to present the medal. They would then have a real good time. All the gas workers should go who could be spared from their work, and all the public who could get inside the Town Hall.

The proceedings closed with three cheers for the Captain and crew [who numbered, all told, nineteen]. Before and after the ceremony hundreds of people were taken out into the stream and boarded the gaily-decked "Wandle," to see the honourable scars she bears.

The following graceful reference to this matter appeared in the "Electrical Times" last week: Our hearty congratulations to the Wandsworth, Wimbledon, and Epsom District Gas Company! In times of peace we have never hesitated to criticize them and their commodity; but the plucky fight of their collier, the good old "Wandle," against a German submarine is not going to pass without a cheer of admiration in these columns. She is no beauty. We have several times seen her punching her way up-stream somewhere by Vauxhall Bridge. She has no masts; and even her funnel is collapsible. But "handsome is as handsome does;" and the manner in which she greeted the Hun submarine disguised as a sailing vessel was lovely enough in all conscience. Of six shots fired, it is claimed that Nos. 4 and 5 got well home. We sincerely hope they did at all events. When the "Wandle" has had her bows, her starboard bulwarks, and her hatch combings repaired in the Tyne, we shall hope to see her smiling through a new coat of tar, and adorning the river once more above the bridges like a joy for ever.

PRESENTATION TO MR. HARRY TOWNSEND, M.INST.C.E.,

Managing-Director of the Wakefield Gaslight Company.

An interesting presentation was made on Monday afternoon of last week at the Wakefield Gas Company's works, by the workmen employed by the Company, to Mr. H. Townsend; the gift consisting of a silver inkstand and silver-mounted ornamental pen. The lid of the inkstand bore the following inscription:

A token of esteem to Mr. H. Townsend, by the workmen at the Wakefield Gas-Works, on completing 21 years as Manager. May 1, 1916.

Mr. W. B. DYSON, who presided, said the workmen had spontaneously decided to show their esteem for Mr. Townsend on his completion of 21 years of management of the Company, by asking him to accept the small token they were about to present. They knew the state of the works when Mr. Townsend was appointed, and the great improvement which he had made in them—an improvement which was not only of benefit to the shareholders and gas consumers, but was also a great boon to the men, as it considerably lightened their laborious duties. He had personally had many interviews upon various matters with Mr. Townsend, in company with delegates representing the workmen, and had always been received most courteously and fairly. He hoped Mr. Townsend would be spared many more years to preside over them. There were thirty men who were at the works 21 years ago when Mr. Townsend first came among them.

Mr. J. BOOTH moved—"That we, the employees of the Wakefield Gaslight Company, offer our congratulations to Mr. H. Townsend on the anniversary of his 21 years as Manager of the Company, and express the hope that he may long be spared to occupy the position."

Mr. T. DEY, JUN., seconded, and, as one who had several times accompanied Mr. Dyson at interviews with Mr. Townsend, cordially endorsed his statement as to the courtesy and fairness with which they had always been received.

The resolution was then carried with acclamation.

Mr. T. MATTHEWS, the Senior Foreman, in making the presentation, said he did so with very great pleasure. They offered Mr. Townsend this gift as a mark of their esteem—not for its value, but as an expression of their goodwill. When Mr. Townsend dipped his pen in the inkpot, it would remind him of the kindly feeling that existed between him and the men; and might he live long to use it!

Mr. TOWNSEND, in reply, said he had never been more surprised in his life than when he was asked to attend this meeting, nor had he ever felt keener gratification. As the Chairman had said, he had that day completed 21 years in the management of the works; and he was extremely pleased to hear that thirty of the men were there when he was appointed. He hoped they would remain many more years. Of course, 21 years was a large slice out of any man's life. He had, as a matter of fact, just completed 40 years in the management of gas-works, having been in charge during this time of the undertakings of three companies and two corporations. His connection with the gas profession now extended to 48 years, he having been articled to a gas engineer in the spring of the year 1868. He thanked the workmen most heartily for this tangible expression of their goodwill, which would be one of his most treasured possessions.

Neath Gas-Workers' Wages.—The minutes of the Gas Committee which were submitted at last week's meeting of the Neath Town Council stated that the application of the stokers and machinemen at the gas-works for an increase in wages had been carefully considered; and that, in view of the decision that no increases be granted until after the war, that war bonuses were being paid, and that the men were already paid as much as was given in other districts, the Committee did not consider they were justified in granting the application. This recommendation was adopted by the Council.

REDUCED LIGHTING CONSUMPTION.

Request of the Board of Trade to Gas and Electricity Undertakings.

The following letter, dated the 1st inst., which has been issued, over the signature of Mr. W. F. Marwood from the Railway Department (Coal) of the Board of Trade, is the subject of comment in our editorial columns to-day.

I am directed by the Board of Trade to state that, as you will be aware, difficulties have been experienced for some time in securing adequate supplies of coal for manufacturers of munitions and other consumers of national importance, owing to the decline in the output of coal from the mines and the increase in the demand for war purposes. The position has been met in the past to a large extent by a restriction of export; but the coal which is now being exported goes largely to meet the urgent requirements of our Allies, or is valuable as a weapon in negotiation with neutral countries.

The Board have observed with some concern the recent decline in coal exports; and, in their opinion, it has become necessary that special steps should be taken to maintain, and if possible to increase, the exportable surplus of coal, and that for this purpose everything possible should be done to encourage economy in the use of fuel at the present time. A copy of a notice which they recently issued recommending a reduction in the consumption of domestic coal is enclosed for your information. [The contents of this notice will be found in the "JOURNAL" for April 4, p. 23.]

The question has been further considered by the Central Coal and Coke Supplies Committee, and they have recommended that a general policy of economy in lighting should be adopted, and that gas and electric lighting undertakings should be asked to do what they can to reduce consumption by a definite amount. The Board think there can be little doubt that there are many cases in which light is at present being used needlessly, or wasted altogether. They have accordingly decided to request the owners of gas and electric lighting undertakings that they should notify to their consumers that the Government desires to see the consumption of coal for lighting purposes reduced by 10 per cent., and that they should do all in their power by notices and inspection to see that this recommendation is carried out.

The Board would suggest that inspectors should be sent round as often as possible to examine meters, and hand to the consumers, where necessary, a notice reminding them of the recommendation, and calling attention to the fact that they have not yet carried it out.

The Board would be glad to be informed in due course of the steps which are being taken in the matter.

POSITION OF YORKSHIRE GAS UNDERTAKINGS DISCUSSED.

Dealing with the Board of Trade circular-letter in last Friday's issue, the "Yorkshire Observer" gave some particulars regarding the present position of a few of the large gas undertakings in that county. It was stated that at Bradford the consumption of coal by the gas undertaking has already dropped by about 10 per cent. Whether it can be further reduced remains to be seen when the Gas Committee have an opportunity of considering the Board of Trades letter.

At Halifax a saving of 2500 tons of coal has been effected as the result of the restriction of street and shop lighting during the past year; 30 million cubic feet less gas having been used. Perhaps a third of the reduction is due to the earlier closing of shops. A 10 per cent. reduction of lighting, as proposed by the Board of Trade, would mean at Halifax a saving of 4000 tons of coal at the gas-works. Mr. W. B. M'Lusky (the Gas Manager) considers it would be quite possible to use 10 per cent. less gas for lighting, if consumers would take a little trouble. Interviewed on the subject, Mr. M'Lusky remarked that the point to aim at was the prevention of waste. One means of doing this was to remember and act upon the old rule to turn down the gas when the kettle boiled. This advice applied to all gas cooking. Also much gas could be saved if consumers did not allow the gas-flame to envelop the vessel on the stove. The flame should impinge on the bottom of the vessel, and thereby none of its heat would be lost. On the question of the use of gas for lighting, Mr. M'Lusky said that if the consumer would give a fraction of the care and attention to his burners and fittings which the user of the oil-lamp bestowed on the trimming of the wick and the general efficiency of the lamp itself, he would be amply repaid by improved light and probably smaller gas bills. A considerable economy could be made by the proper regulation of the gas. All the burners which were regularly used should be lighted; and the tap at the meter should be turned off until the lights began to diminish. Then the consumer would know the supply was restricted to the exact amount required. Gas was wasted by allowing it to pass through the burner in excess of the quantity needed to give a good light; and the atmosphere was rendered vitiated or stuffy. Another fact was that if more gas than was necessary passed through the burner, the quality of the light was deteriorated. In factories where the pipes were of sufficient size, a separate governor should be fixed on the supply to each floor to control the pressure on all the burners at each particular level. This would result in unvarying pressure, uniform consumption of gas, and a steady light at each burner. Mr. M'Lusky gave a concrete illustration of the economical effect of proper attention to burners. He said that in an eight-roomed house in Halifax last winter the gas bill for lighting had been reduced about one-half by the means outlined.

The only curtailment in the supply of artificial light at Huddersfield has been in connection with street lighting. Some 60 per cent. of the gas-lamps are not lit; and the saving which has been effected in coal at the gas-works is equal to 2000 tons per year. The price of gas has been advanced; but the private consumption has gone up considerably. As a result of improved methods of production, 600 cubic feet more gas have been obtained per ton of coal used during the year ended March 31 last than in the previous year. It is pointed out that if further economy is to be effected in the use of coal for lighting purposes, house-

holders alone can bring it about. A strong point is made of the utility of coke for house-fires. During the winter months there was a big demand for coke; but this is not the case to-day. The consumption of more coke and less coal would ease the situation all round.

While the Keighley Corporation Electricity Department has shown a marked advance in production during the past year, the gas undertaking records a diminished output. During the past nine months, the gas made has decreased by 36 million cubic feet; and this has been due in a measure to business firms having substituted electricity for gas for power purposes. Alderman J. Harrison (the Chairman of the Committee) pointed out also that, in consequence of the price having been advanced by 5d. per 1000 cubic feet to ordinary consumers since July last, the townspeople had exercised economy in gas both for lighting and cooking. The serious curtailment of public lighting, too, had contributed to the drop in output. He could not see much chance of a further reduction in the use of coal for gas making.

A Gas Manager on the Situation.

In a letter to the "Manchester Guardian," a "Gas Manager" says he is in a dilemma. The British Commercial Gas Association last December issued a circular stating that the continued and increased use of gas was at the present time of vital importance; and now there was the circular of the Board of Trade calling for economy in lighting. "Now," he asks, "which advice am I to follow? One authority infers that it is imperative to use as much gas as possible, and the other that it is desirable to use as little as possible. It seems to me the Board of Trade would have been better advised if they had issued a circular urging the importance of using gas and electricity, and discarding the burning of coal in a raw state."

MILITARY SERVICE BILL, 1916 (SESSION 2).

The Bill which was introduced into Parliament last week, to make further provision with respect to military service during the present war, contains, among others, the following sections.

Every male British subject who has at any time since Aug. 14, 1915, been, or for the time being is, ordinarily resident in Great Britain, and who has attained the age of 18 years, and has not attained the age of 41 years, shall, unless he either is for the time being within the exceptions set out, or has attained the age of 41 years before the appointed date, be deemed as from the appointed date to have been duly enlisted in His Majesty's regular forces for general service with the Colours or in the reserve for the period of the war, and to have been forthwith transferred to the reserve. The appointed date shall, as respects men who come within the operation of this section on the passing of this Act, be the thirtieth day after the date of the passing of the Act; and, as respects men who come within the operation of this section after the passing of the Act, be the thirtieth day after the date on which they so come within the operation of this section.

Prolongation of Expiring Terms of Service.

During the continuance of the present war, sub-section (1) of section 87 of the Army Act, and sub-section (5) of section 9 of the Territorial and Reserve Forces Act, 1907 (which relate to prolongation of service in certain cases), shall have effect as if after the words "not exceeding twelve months" where they occur in those sub-sections respectively there were inserted the words "or in the case of the present war not exceeding the duration of the war."

Modification of Exceptions from Service.

Paragraph 5 of the first schedule to the Military Service Act, 1916 (called the principal Act), shall cease to have effect so far as it relates to men who have been discharged from the naval or military service of the Crown on the termination of their period of service.

Paragraph 6 of the first schedule shall, on Aug. 1, 1916, cease to apply to a man who has offered himself for enlistment and been rejected since Aug. 14, 1915, unless the Army Council are satisfied that he need not again present himself for medical examination, and send him notice to that effect.

Certificates of Exemption.

Where a decision of a local tribunal has been varied on appeal to the appeal tribunal, any certificate of exemption granted in pursuance thereof shall be reviewed or renewed only by the appeal tribunal on an application made direct to that tribunal, and the provisions of the principal Act as to the review or renewal of certificates of exemption shall apply accordingly. A certificate of exemption may be granted under the principal Act subject to the condition that the certificate shall not be renewable except on an application made with the leave of the tribunal; and unless leave is so given, the provisions of the principal Act as to the renewal of certificates shall not apply to a certificate granted subject to such a condition. The decision of the tribunal granting or refusing leave under this provision shall be final.

Sub-section (3) of section 3 of the principal Act shall be construed as if "two weeks" were substituted for "two months," and as if the words "unless in the meantime the man has made an application for a renewal of his certificate" were substituted for the words "unless in the meantime the man has obtained a renewal of his certificate."

Producing Certificate.

Every man who holds a certificate of exemption granted under the principal Act shall, if required by a constable or by any person who has authority for the purpose from the Army Council, produce his certificate or give particulars as to the authority by which the certificate was granted and the grounds on which it was granted. If any man fails to comply with this provision, or gives particulars which are false in any material respect, he shall in respect of each offence be liable on summary conviction to a fine not exceeding £20 or to imprisonment for a term not exceeding three months.

Thus all men, married or unmarried (with stated exceptions), between 18 and 41 are to be subject to compulsion. All time-expired men will be liable, if under 41. The Army Council will have power to re-examine all those medically rejected since Aug. 14.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Meeting of the Company was held last Thursday, at the London Offices, Moorgate Street Chambers, E.C.—Mr. H. E. Jones in the chair.

The Secretary (Mr. A. Dickson, jun.) read the notice convening the meeting; and the Directors' report and statement of accounts were taken as read.

Full Dividends and Reduction in Price.

The Chairman, in moving the adoption of the report and accounts, said they were meeting very peacefully and quietly there that day, which was rather extraordinary after nearly two years of war. Why were they meeting so peacefully and quietly? One solution of it was that they had a strong Navy, which was ready when the war broke out, thanks to the maritime spirit of the nation. Although meeting in this quiet way, he had an astonishing and amazing story to unfold to the shareholders. As they had gathered from the report, they were going to receive their dividends in full. This was a most surprising result, because he did not know of a gas company anywhere that had not had to raise the price of gas, and had had (especially those under the sliding-scale) to forfeit part of their dividends. The next thing that would, under the current circumstances, probably shock the shareholders—this was a dear ambition of the Board, and had been emphasized and impressed upon them by their Engineer and Manager in Bombay (Mr. A. R. Burch)—was that the Directors had decided to reduce the price of gas in Bombay by the not insignificant proportion of 4d. per 1000 cubic feet—not insignificant inasmuch as 4d. was the smallest addition made to the price of gas by any one of the London companies, and it had in this country been almost the general rule. But the shareholders would understand that there were some circumstances in which this Company was far removed from the circumstances of European and British gas companies. It was due to this that they were able to announce the reduction in the price of gas while not diminishing the dividend. He should unfold the reason for this state of things by his observations on the accounts.

Profits and Stocks.

Being an engineer, he preferred to look at the accounts the opposite way from what the auditors would do. He would not begin as they would at the expenditure of capital; but at the balance-sheet at the other end. He should look to see what was the profit to the credit of net revenue; and if it were a few hundreds more than last year, then he should say that it was all right, that the dividend was there, and properly there. In the balance-sheet, too, he should be concerned to see how the stocks stood, because they could get inflation of profits by inflation of stocks; and, therefore, unless the stocks were reasonable, he should not "crow" much about the profits. They would see that the stock of coal, which amounted to £14,698, was larger than last year by some £6000. This was a position that was again amazing, seeing that in France, Italy, and even this country coal stocks everywhere were very poor indeed, although they had actually the source of coal living by them in this kingdom. But in their own case stocks were up in value and in volume. Stores of general materials (which constituted an item they had to look after very jealously) were down from £24,100 to £23,700. They wanted to keep this item in the right direction, because the accumulation of old stocks in companies was a disadvantage, and should be kept down to a reasonable level. The item "Temporary loans, £33 000," was up by £9000, because their efforts to get fresh capital had been baffled by the Treasury, who refused their sanction to any new issue. The Company had therefore to rely for money supplies on their bankers, who were complaisant in the matter so far; but the Directors did not know how long they could go on assisting them.

The Revenue Account.

Going to the revenue account, the balance of profit was £23.900, which was what the dividend depended upon. It was only £186 less than last year. This was remarkable, because the price of gas had been the same, but they were now, as he had said, going to reduce it. The expenditure on coal (including freight, &c.) was £540 more. There had been on the other side a loss on the gas sold; but this had been insufficient to, in any way, interfere with their profits. From residuals, which they always had to take in connection with coal (because they had the advantage that their coal gave them a return for products which the electrical people did not obtain), their income was £1153 less than in the previous year. Thus it would be seen that the total difference to them on coal and residuals was—*plus* £540 on coal, and *minus* £1153 on residuals—altogether £1693. But they had made some savings otherwise. It would be observed that their repair and maintenance of works account was some £2000 less than it was the previous year. This was not due to their having starved the undertaking; but they had deliberately, in face of the Treasury order—not to spend more money on capital account than could be avoided—kept down the class of work which they usually carried out for the purpose of improving their plant. The works had not actually been in any way sacrificed. The saving was rather what he might call the saving of luxury—the luxury of having the most modern apparatus at once; and for this they would now have to wait until the war was over. In minor manner, the same thing applied to the outdoor department, in which there had been a saving on repairs and maintenance of £970, out of £7700; so this was purely nominal. But in the outdoor department it would be seen they had had to spend something on capital account for the laying of additional services. It would not do to tell a prospective customer that he must wait for a supply of gas until the war was over. He (the Chairman) thought the shareholders would agree with him that, although it was costly to lay pipes (Mr. Samuel Spencer would tell them that the cost of pipes was very much higher now than formerly), they must lay some, but as few as they could. They must, however, keep their business going; it would never do to let it slip back because the war was on. With regard to the repair and replacement of meters, they appeared to have been liberal, and had spent £350 more than in the preceding year. The rest of the accounts

carried nothing on the face of them for comment; the other items being quite normal.

GOOD RESULTS FROM INDIAN COAL.

Now he was going to report how they arrived at this position of being able to pay the shareholders the full dividend, and to reduce the price of gas. The carbonizing returns of the Company were most creditable, as Mr. Drew, in his capacity of Auditor to many companies, would confirm. Mr. Burch succeeded in getting excellent returns from his raw material (which was formerly English, and latterly Australian, which was a finer coal than the English), although embarrassed with high freights. But now he was getting these returns from the "common or garden" coal found in Eastern India. They used the same coal as the Calcutta Company, but it had to travel across the whole of India from east to west to get to the Bombay works. Why the Company did not use it many years ago, he could not quite conceive. They then carbonized English coals, which were, of course, much cheaper then, and the rates of freight were lower than now. But the upshot of it was that they had secured all their coal for two years ahead at a price that would compare well with that in the accounts they were now considering. This enabled them to say with confidence that they could reduce the price by the amount he had announced to them. The price of gas in Bombay had always been a great deal too high; and, cheap gas man as he was, he had felt staggered and aggrieved by the price. Since, however, Mr. Burch had been their Engineer they had reduced the price of gas twice before, and now there was this further reduction; so that, owing largely to their carbonizing and manufacturing returns, they had had, in the last eight or nine years, an improvement in the way of a lower price by 1s. 8d. per 1000 cubic feet. This was a good record. This concluded the amazing and wonderful tale he was going to unfold when he got up to speak. The Company's position at the present moment was unrivalled in its history; and he was very fortunate in being able to say this at the present day. They had not succeeded yet in renewing the public lighting contract, which was hanging in the balance, and had been postponed until after the war.

The DEPUTY-CHAIRMAN (Mr. W. G. Bradshaw) seconded the motion.

Mr. SAMUEL SPENCER said he desired in the name of the shareholders to congratulate their Chairman upon having recently been elected a Vice-President of the Institution of Civil Engineers. This was a great and distinguished honour. He had himself been an associate of the Institution now for nearly forty years; and this was the first time he had ever known a gas engineer get any further than being a member of the Council. He hoped that in a few years their Chairman would have bestowed upon him the highest honour it was possible for engineers to accord to anyone in the profession. He was also delighted to see Mr. Charles Carpenter elected a member of the Council.

The CHAIRMAN thanked Mr. Spencer for his kind remarks; and the motion was unanimously adopted.

Proposed by the CHAIRMAN, and seconded by Mr. A. W. OKE, the retiring Directors (Field Marshal Sir Evelyn Wood, V.C., G.C.B., and Mr. Charles Hunt) were unanimously re-elected.

Moved by Mr. J. MITCHELL, seconded by Mr. A. W. BROOKES, the Auditors (Mr. Spencer Gore Browne and Mr. Ernest Drew, F.C.A.) were re-appointed.

The CHAIRMAN said that, although they had escaped the high prices which had sacrificed some of the profits and dividends in this country, they had not escaped a good deal of the anxiety and risk, and some of the coal had cost them a larger price than anything they had paid before in the history of the Company. Therefore their thanks were due to the capable and efficient help they had had from the whole of the staff. The head of the staff, Mr. Burch, was working for them 5000 miles away. He had an efficient assistant in Mr. Lane, who was devoted to his work. Mr. Woodford was also an Englishman; and they had two or three other Britishers on the staff. The officers and the rank-and-file all worked efficiently and diligently. In fact, he had never seen technical returns that could in any way be held to be better than, and very few that were able to equal, those in the accounts before them. Mr. Burch would be very gratified to know the Directors had made the further reduction in price. As to the London office, they had Mr. Dickson, who was always courteous and friendly and a cordial co-operator. In the accountants' department was Mr. Comber, who was among the accomplished gas accountants working in London; but, as one of the junior members, he might soon have to join the Army.

Mr. LOUIS PENNY seconded the motion, which was heartily passed.

Mr. DICKSON said he should like to express his cordial appreciation, on behalf of the officers and staff in Bombay, as well as for his own staff and himself, of the hearty acknowledgment by the Chairman and Directors and the shareholders of their services. The approbation of those whom one served was perhaps the highest form of reward one could expect; and they were very pleased to receive it.

Proposed by Mr. F. R. SMITH, and seconded by Mr. MITCHELL, a cordial vote of thanks was passed to the Chairman and Directors for their services.

The CHAIRMAN said his colleagues associated their thanks with his for the graceful acknowledgment of their work. A few words of thanks were worth a great deal of scolding and criticism. [Laughter.]

SOUTHAMPTON GAS COMPANY.

The Coal Freight Difficulty.

The Half-Yearly Meeting of the Company was held last Wednesday, when a report was submitted which stated that the sale of gas for the six months showed an increase of 19,624,000 cubic feet, or 4½ per cent., over the corresponding period of 1914. The revenue from coke and sulphate of ammonia showed an increase; but that from tar a decrease. The profits for the six months amounted to £19,285, and the balance available for dividend on the ordinary stock, after payment of debenture interest and other charges, to which was added £3359 the undivided profit from the previous half year and £95 interest, was £19,744. The Directors recommended that the maximum dividend of 5 per cent. per annum, amounting to £16,193 for the half year, be paid (less income-tax); leaving a balance of £3551 to be carried forward.

The CHAIRMAN (Captain A. J. Corse-Scott, J.P.) said that the accounts were very gratifying. The moderate increase in the price of gas of 4d. per 1000 cubic feet, combined with a larger revenue from coke and sulphate of ammonia, had enabled the Company to meet the higher cost of raw materials, and to carry forward a slightly larger balance. Coal had cost upwards of £9219 more than in 1914, nearly all of which was for increased rates of freight. The allowances paid by the Company to dependants of those employees serving with His Majesty's forces on land and sea had increased by nearly £500. They had done, and were doing, their utmost to assist the Government by releasing as many men as possible, and no exemption had been applied for except for such men as were considered absolutely indispensable. All employees of military age had, with very few exceptions, been attested. The next accounts would not be so favourable as those now under review; the main reason being the price of freights and oil. In the early part of last year, the steamer chartered by the Company was requisitioned, and for a short time coal had to be carried in other boats at an increased cost; but happily arrangements were made whereby the steamer was released, and the Company enabled to get delivery of all the coal required at only a moderate increase on pre-war prices. Early this year the Admiralty requisitioned the steamer, and so far had done nothing to assist the Company to obtain another boat to replace her. Had not provision been made last year by building-up a large stock, the Company ere this would have had to close-down their works for lack of coal. A few boats had been obtained from the Admiralty Coasting Trade Department, at the high figure of 17s. 6d. per ton for freight. The tonnage available was, however, not nearly sufficient, and unless the Admiralty would soon release the Company's boat the situation would be very serious. Moreover, at the present prices for freight the Company would be compelled to increase the price of gas to the maximum allowed under their Acts of Parliament, and also to withdraw all discounts at present allowed to large consumers of gas. Should the Directors be compelled to take these steps, it would be solely because of the action of the Admiralty, who had requisitioned the Company's steamer. In the negotiations that had ensued, the Directors desired to express their thanks to the efforts made on behalf of the Company by their Coal Contractors (Messrs. Stephenson Clarke and Co.), who had placed at the disposal of the Company their expert knowledge, and had spared no efforts in endeavouring to obtain freights at as low a cost as possible. To add to the Company's difficulties, a favourable contract for oil had just expired. Although it was not possible to obtain all the oil contracted for, sufficient was secured to carry the Company through last year. The position to-day was that only about one-third of the oil needed could be purchased, and the price had increased 200 per cent. The Admiralty had requisitioned a very large proportion of oil steamers available; and the outlook for regular supplies in the future was at the present time rather gloomy. The number of employees now serving with the forces was nearly 12 per cent.; and there was but little doubt many more would be taken. Every effort would be made to carry on the work of the Company with as little inconvenience to the consumers as possible; but the Directors would again ask that every consideration should be shown by customers.

The report was adopted, and the maximum dividend declared.

TRIBUNALS AND EXEMPTION APPLICATIONS.

Last week, Dr. E. B. Maxted, who is connected with a Company called Gas Developments, applied to the Walsall Tribunal for the exemption of an assistant who, it was urged, was assisting in the development of a process for the synthetic manufacture of ammonia and nitric acid. The importance of the work lay in the fact that nitric acid was the basis of all explosives, and, with ammonia, of most agricultural fertilizers. In reply to questions, Dr. Maxted said the business of his Company at present was purely experimental. They were developing the processes with a view to applying them to industry, and were in touch with the Admiralty in connection with the production of hydrogen. The Military Representative expressed the opinion that the Tribunal should have corroborative testimony that the work in which the young man was engaged was of importance from the war point of view. The application was adjourned for a fortnight; and the Mayor pointed out that if a recommendation were obtained from the Royal Society, the assistant would come within the official list of exempted occupations.

At a sitting of the North Riding County Appeals Tribunal, held at Middlesbrough last Friday, application was made by a firm in respect of men employed at ironstone mines, coke-ovens, and blast-furnaces. It was stated that the tribunals below had refused to grant exemptions, on the ground that the firm were not employed wholly on munitions. But it was pointed out that 90 per cent. of the work was for Government purposes. The firm were under contract for the supply of spare blast-furnace gas required for the purpose of generating electricity. Surprise was expressed that the men applied for had not been exempted by the local Tribunals; and in all cases, with the exception of six whom the firm agreed to release, exemption was granted until Oct. 1, conditional upon the men remaining in their present employment. It was stated that the men had been badged since the first hearing of the applications.

Before the Oxfordshire Appeal Tribunal, Ronald Goodsell, a gas worker, of Wadhurst, Sussex, appealed against the decision of the Chipping Norton Rural Tribunal. He stated that he had conscientious grounds, that he was in ill-health, and was in certified occupations. The reasons for refusal were: Conscience appeal not proven; occupation not indispensable; employer made no appeal." H. Wilcock (the Manager of the Bicester Gas-Works) said the appellant was employed inside the works. He believed that owing to nervous breakdown Goodsell, who was aged 21, was not attested. The appellant was now employed at the Wadhurst Gas-Works. Exemption for three months was allowed, on the ground of certified occupation.

AIR-RAID PRECAUTIONS IN EDINBURGH.

Second Gas-Warning Experiment.

At the conclusion of the article in last week's "JOURNAL" (p. 234), it was stated that a second, and bolder, experiment in gas-pressure reduction was to be undertaken in Edinburgh. This was duly carried out on the night of May 1, with results that were, if not perfect, at all events far more satisfactory than on the first occasion. Commenting on the initial experiment, the Consulting Engineer (Mr. W. R. Herring) and the Resident Engineer (Mr. Alexander Masterton) observe that, from the reports of the Commissioners' inspectors and others, and the communications voluntarily sent in by a number of consumers, it is evident that the moderate reduction of pressure (25 to 30 per cent.) which was given effect to was only just sufficient to bring about a slight diminution of the lighting, and that in but a few instances could it be considered a sufficient warning.

At a meeting of the Commissioners held last Wednesday, a report by the Engineers as to the second experiment was submitted. They stated that the pressure was reduced 50 to 60 per cent.; that, generally speaking, the effect was observable throughout the entire area of supply; that only in a few cases had consumers reported that their lights had been extinguished; and that the trial was as satisfactory as such a method of warning could be expected to be in a district that was affected by so many disturbing factors. The Commissioners resolved that, when called upon to take air-raid action, the pressure of gas be reduced as on the night of the second experiment, and that it be restored to normal conditions after danger from air-craft ceased.

From letters and editorial comments in the local Press, we judge that there is a feeling in Edinburgh that the Gas Commissioners might have taken a still bolder course, and so made the warning more effective. The "Scotsman," in a leading article dealing with the Zeppelin raid of last Tuesday night, remarks: "Municipalities are becoming wary in their precautionary measures. Are the Edinburgh authorities fully satisfied that they are among the bodies who have done everything possible to outwit the midnight murderers? Are they ready to accept the complacent report of the Gas Commissioners as the maximum of preventive efficiency? If they are, they will surprise many householders, who can tell them that the lighting experiment on Monday night was not effective as a warning. The Edinburgh Town Council have agreed that the citizens have a right to be warned of danger; if they accept the report of the Gas Commissioners as satisfactory, they will fail to secure a large class of householders in enjoyment of that right; and they will besides have to endure the reproach that the arrangements for quickly bringing absolute darkness on the city are still deficient."

The fact that the lowering of the pressure by more than one-fourth made little (if any) visible effect has caused consumers to conclude that the normal pressure is excessive. "Now that everyone is preaching war economy," writes a correspondent, "the Gas Commissioners have here a splendid opportunity of practising it in their works, and at the same time benefiting the gas consumers as a whole." Certain it is that these experiments have provided the Engineers with valuable data, not obtainable under ordinary working conditions; and it is possible they may see their way to advise some change in existing arrangements.

Following upon the completion of the arrangements for warning gas consumers by reducing the pressure, the Chief Constable of Edinburgh has issued supplementary instructions to the citizens. He states that, on his receiving information that an air-raid is imminent, the electric light will be reduced to a dull glow, and the gas to a minimum. The police at the same time will do their utmost to warn householders who use neither gas nor electricity; and this should be the signal to them to extinguish all inside lights. Gas consumers are requested to extinguish their lights by turning off the taps at the gas-jets and the meter; and those householders, shopkeepers, &c., who are in the habit of keeping a small gas-jet or jets burning overnight, are advised to discontinue the practice, as, with the gas reduced to a minimum, the light may go out, with the risk of suffocation and explosion when the normal pressure is resumed. When danger is past, the police will blow their whistles throughout the streets of the city.

PUBLIC LIGHTING OF READING.

Present Reduced System to be Maintained.

Resolutions of the Finance Committee fixing borough rates for the current year to meet the expenditure included in the estimates submitted came before the Reading Town Council at their quarterly meeting last Thursday.

Alderman POULTON proposed: "That the Highways Committee's estimate be generally reduced by the sum of £800." He had, he said, thought it wise perhaps to accept the 4d. reduction in the rates; but if every Committee spent actually what was set out in the finance estimate, there would be a deficit of £796. There were many ways in which they might reduce on the highways, and two which specially he thought the Council should adopt. One was that the lighting of the public lamps should be discontinued entirely; and then he suggested they should discontinue the watering of the streets on Sundays.

Mr. WINTER seconded the resolution. He felt they ought to save something more.

Mr. W. E. COLLIER pointed out that the expenditure on street lighting had been greatly reduced—quite as much, he thought, as the public were willing it should be reduced. [Hear, hear.] Any further reduction would be exceedingly inconvenient, and also to the danger of the public. They had reduced the illumination by 50 to 75 per cent.; and to effect an alteration in the burners would cost more than would be saved by the reduction of light. They might spend less on the maintenance of the surface of the streets; but this would result in great deterioration and inconvenience to vehicles. Providing reduced lighting was maintained throughout the year, there would be a considerable saving on the estimate of £4500 which had been put down under this heading; and this was the only hope they could hold out.

Alderman MARTIN said the Gas Company had met them very reasonably indeed, because they were under contract with the Company, and could not compel them to make any reduction, though they were burning less gas at the present moment.

Mr. QUELCH pointed out that the Highways Committee, by refusing to deal with roads as occasion demanded, were simply building up heavier expenditure than would otherwise be necessary when the war was over. This was absolutely false economy.

Mr. E. P. COLLIER observed that if it was desired to do away with Sunday watering and with gas lighting, he wondered why they did not propose it for a certain period of the year.

Alderman Poulton's resolution was then put and lost; 15 voting in favour, and 25 against.

NOTTINGHAM GAS PROFITS.

The value of municipal undertakings in relief of local burdens has been, on many occasions, strikingly exemplified by Nottingham's experience; but never have the Corporation had greater cause for gratification than at this juncture. Naturally it had not been expected that the gas revenue, from which the largest measure of help has always been looked for, would, under present conditions, permit of so generous a contribution as in previous years. But the budget presented at yesterday's meeting of the Corporation disclosed the possibility of the Committee voting no less than £35,000 in relief of local burdens, which falls short by £4000 only of the sum available in immediately preceding years, and supplies a notable proof of efficiency of management in present difficult times.

In all, £60,350 is on this occasion to be taken from the profits of the three main revenue-earning concerns, compared with £71,000 at the last municipal levy; the tramways contributing £20,350 (as against £22,500), and the electricity department £5000 (compared with £9500). With rigid economies practised in various branches of the public service, the Corporation find themselves in the happy position this year of being able to reduce the district rate by 5d. in the pound, a result which would have been impossible of attainment, but for the continued remunerative management of the chief municipal trading concern.

The object has not been achieved without an inevitable increase in the charges to consumers; an advance of 12½ per cent. having been made to all customers, including consumers for power and gassing purposes. Prices for gas used through prepayment meters remain as before, save that the rebate of 1d. in the shilling has been discontinued.

FORMBY DISTRICT COUNCIL AND THEIR CHAIRMAN.

The "JOURNAL" was quoted in the course of a debate at the Formby Urban District Council meeting on Monday evening of last week, to show that there is nothing inconsistent or illegal in an official of a private gas company doing business with the Council, holding the position of Chairman of that Council.

Mr. RIMMER (who pointed out that what he was going to say was not said out of any malice or spite against the Chairman, Mr. J. H. Buckley) remarked that he would like to know what their Law Clerk had to say about Mr. Buckley's position as Chairman of the Council. Mr. Buckley made a good Chairman; but he was Manager of the Gas Company, and also had control of the roads so far as the mains were laid. Now, in the lighting season, he would seal his own document. If the Law Clerk could point out to him and to the ratepayers how Mr. Buckley could hold these two positions without damage to the Council, or without the risk of being surcharged, he would be perfectly satisfied.

Mr. A. D. DEAN (the Law Clerk) said the Formby Gas Company was a limited company; and that being so, whether Mr. Buckley was a shareholder or not did not matter, and whether he was a director or not did not matter. So long as it was a limited company, the Council were perfectly justified in dealing with it. There was no legal objection of any kind. The fact of his being Chairman made no difference. It was exactly the same as if he were an ordinary member.

Mr. RIMMER: You say that you can neither buy nor sell if you are a councillor.

The LAW CLERK: We are dealing not with Mr. Buckley, but with the Formby Gas Company, which is a limited company. Mr. Buckley is not recognized in the matter so far as the law is concerned. It would not matter if all the members of the Formby Gas Company were members of the Council.

Mr. LAYTON said that he would have moved that they declined to discuss the matter, had he not thought the Chairman personally would prefer it should be discussed. It seemed to him that if a question like this did arise, it should have been raised at the time that Mr. Buckley's election to the chair was moved. It was perfectly obvious to him that there could be no valid objection at all. Interest in possible contracts, or in doing business with the Council, could not be an objection to a man sitting on the Council, though it might be a good objection if he voted on the particular business. Surely, if there was anything in Mr. Rimmer's point it would apply equally to a man being a member of the Council as to a man being Chairman of the Council. Mr. Buckley, they all knew, had always been particularly careful in his conduct on the Council; so that nothing of the sort could be brought against him. He had never voted when matters affecting business between the Council and the Gas Company had been under consideration. He was sure Mr. Buckley's conduct in the past deserved the confidence of every member of the Council. ["Hear, hear."]

Mr. RIMMER: I hope that you do not take it wrongly. I have been asked by ratepayers to bring the matter forward.

A MEMBER: Name them.

Mr. BUCKLEY (who had asked leave to vacate the chair during the

discussion), in reply, said one would have welcomed such a query if it had been raised a fortnight previously when he was elected. He was not [and here the Chairman quoted from recent issues of the "JOURNAL"] the only gas engineer, or gas manager, in the British Isles who occupied the position of chairman of an urban district council; and, in addition to this, one would find if one took the trouble to see, that gas engineers and managers were even mayors of boroughs. So far as his position was concerned, as it had been in the past so it would be in the future—not to take any part, either by voice or voting, in matters in which he was concerned as a direct official. What more assurance could he give them, than that, in this respect, he would be neutral?

It was then decided to go into committee.

NOTTINGHAM GAS-WORKERS' WAGES.

When recently applications were made by the employees working under the Gas, Health, and Works and Ways Committees of the Nottingham Corporation for an all-round increase of pay, the matter was settled without any great difficulty as far as the two last-named departments were concerned; substantial advances being conceded to those engaged in scavenging, and upon duties in connection with the maintenance of streets and sewers. But it was felt that the case of the gas-workers rested on a different basis. There was not only the fact that the request was being made at the time of inordinately heavy demands upon the resources of the principal municipal trading undertaking, but also the circumstance to be considered that it was not so many months since the same workmen, following upon long-sustained agitation, culminating in an award made by Sir George Askwith, succeeded in obtaining an increase of 2d. per shift. It was felt that, he being conversant with the facts, no better course could be adopted than to again refer the question to the arbitration of the Chief Industrial Commissioner, with whom an interview took place at Westminster on Friday. This was attended on behalf of the Corporation by Alderman A. Ball, Chairman, and Mr. H. Gover Ford, Vice-Chairman, of the Gas Committee, the Engineer (Mr. John Wilkinson), the Town Clerk (Mr. W. J. Board), and Mr. F. B. Harris (Solicitor to the Corporation). The workmen were represented by Mr. Will Thorne, M.P. (General Secretary of the Gas-Workers' Union), and Mr. Arthur Hayday (who, in addition to being Branch Secretary of the Union, also occupies the position of President of the Nottingham District Trades Council).

Broadly speaking, the demand of the men (the advocacy of their case by Mr. Thorne and Mr. Hayday was supplemented by the statements of delegates from Nottingham) was for an increase upon various classes of work which would amount altogether to about 1d. an hour; but the Chairman and Vice-Chairman of the Committee, together with the Town Clerk and the Gas Engineer, suggested potent reasons why, in the view of the Committee, the Arbitrator should not be too ready, at this difficult juncture, to acquiesce in the liberal estimate which the men, backed by the Member for West Ham, have placed upon the value of their labour.

Sir George Askwith deferred his decision, the announcement of which is expected at an early date. Approximately the matter affects 700 men concerned in the manufacture or distribution of gas; so that it will be seen a serious addition to the wages bill is involved.

A TAR-DISTILLING PLANT FOR BURNLEY.

The Burnley Town Council decided last Wednesday, on the recommendation of the Gas Committee, to install a tar-distilling plant at the gas-works, and accepted a tender amounting to £2800. The recommendation was made after considering the following report from the Engineer (Mr. J. P. Leather).

Since the last meeting of the Committee, I have visited the works of the Talk-o'-th'-Hill Colliery Company. They have there an installation of Hird's patent stills of the same size as those which I suggest for our works. They have, however, four stills in place of three, and pass through the plant 26 tons of tar in 24 hours. The plant is the first one erected of this type. Some slight modifications and improvements are incorporated in newer plants, but no essential difference. The Manager spoke very highly of the ease of working and absence of anxiety, as compared with the older kind of plant of which he has had a lengthy experience. The most striking features are the small size of plant compared with the amount of work done, and the remarkable absence of smell and nuisance. I have been on many works; and this last attribute appealed very strongly to me. The plant was in full work. The flow of the various distillates and of the pitch could be plainly seen; but no smell was discernible.

I made particular inquiry into the question of wear and tear. The only part on which there is any serious depreciation is in the heating tubes. Those in the second still corrode most quickly, and require renewing after about 7000 tons of tar have been dealt with. They have had practically no other repairs; the total cost being under 2½d. per ton of tar. In my estimate, I allow, however, 10 per cent. depreciation on the full cost of the plant, which would cover all probable happenings.

The first two stills (in a three-still plant) are heated by gas. The third has live steam passed into it, which carries off the vapours of anthracene oil. From this the pitch passes into a pitch-cooler, before running out into the pitch-bays, where it solidifies. Before entering the first still, the tar is partially distilled and dehydrated by passing through heaters which contain coils conveying the hot vapours from the stills to the condensers. In this way, the water and crude naphtha are driven off gently without any risk of frothing by heat, which would otherwise be wasted. The apparatus, therefore, not only works smoothly but with economy of heat.

The plant being kept at a constant temperature, supervision is reduced to a minimum. At Talk, they work continuously for seven weeks. The plant is then stopped, and the stills cleaned out, except the last still, which does not need cleaning. The facilities for cleaning have been improved in more recent installations; and I am informed that the operation of cleaning does not now involve more than 24 hours' stoppage. In the figures of cost given below, I have, however, allowed for labour in accordance with the information that was given to me at Talk.

We are at some disadvantage in not having a railway siding to our works. The cost of carting the liquid products and putting them on rail would be considerable. I propose that a 2 inch pipe be laid to the siding at Manchester Road station, similar to the one we already have for conveying gas-oil to the works. The oils could then be easily put into tank-waggons by means of compressed air. Probably the Highways Department would take about half our make of pitch.

I estimate the working costs per ton of tar as follows:

	s.	d.
Labour	1	1
Fuel	1	6
Putting on rail part of products	1	0
10 per cent. depreciation on £3000	1	8
	5	3

The tender of Messrs. W. C. Holmes and Co. is £2800 for a plant having a capacity of 20 tons of tar per day. This includes five tanks of a capacity of 5000 gallons each for the products of distillation, and also naphthalene-pans of a like capacity for crystallizing out naphthalene from the creosote oil, with the necessary creosote pump and connections. I propose to use as a tar-feed tank an existing cistern formerly employed for the water supply of the works. I have added to the estimate £200 to cover the cost of pipe-line, air-compressor, and other incidental expenses, making the total estimated cost £3000. The tar we produce yields the following products per ton, which are valued at the price which could be obtained at the present time:—

		d.		£	s.	d.
15 gallons	crude naphtha	at 6	..	0	7	6
28 ,,	light oil	,, 5	..	0	11	10
20 ,,	creosote	,, 2¼	..	0	3	9
24 ,,	anthracene oil	,, 2½	..	0	5	0
11⅓ cwt.	pitch	,, 9	..	0	8	7½
				£1	16	8½

In putting the pitch at 9d. per cwt., I am taking a low price, at which it would pay us to carbonize it in our retorts, mixed with the coal. In this case, there would be no carriage to railway. The above figures show a net receipt of 31s. 9d. per ton of tar, compared with 19s. 3d. offered by tar distillers. The difference on 3600 tons of tar per annum would pay off the cost of the plant in eighteen months.

The makers have communicated with the Ministry of Munitions, and expect to be able to complete the plant ready for work before the end of July. From April 1 to July 31 we shall produce about 900 tons of tar. We can store in our tar-well about 700 tons. Our liquor-well has a capacity of 1400 tons. By arranging to have only a small stock of ammoniacal liquor, several hundred tons of tar can be accommodated in the liquor well without inconvenience. The proposed feed-tank has a further capacity of 60 tons. There appears, therefore, to be no difficulty in storing the tar produced until the plant is ready.

LEEK GAS-WORKS RESULTS.

Mr. R. H. Ginman, the Engineer and Manager of the Leek Urban District Council Gas-Works, in his second annual report to the Lighting Committee, dealing with the year ended March 31, says the quantity of gas sold through ordinary meters increased by 2 548,900 cubic feet, and the rental therefrom by £703. Through slot-meters, 1,734,300 cubic feet more gas was consumed; the receipts being £658 greater. The receipts per 1000 cubic feet for gas sold through prepayment meters was 2s. 10 6d., as against 2s. 7·6d. for the previous year. The average rental from all gas sold and accounted for amounted to 2s. 5·4d. per 1000 cubic feet, compared with 2s. 1·9d.; the total revenue from gas being £14,146, against £12,915, or an increase of £1231. Instead of purification costing £122, as in the previous year, a profit was realized under this head amounting to £156, or 3·781d. per ton of coal carbonized. A lot of work has been done in fitting installations for gas heating, cooking, lighting, and power.

The total income from all sources for the year was £20,149, which was £2221 more than for the preceding year, and the highest income in the history of the undertaking. The expenditure, at £16,106, was £1300 more; coal alone costing £1275 more than in 1915. Adding to this the extra for rates and taxes, the £1300 increase was more than accounted for. The gross profit for the year was £4043, or an increase of £921; and the net profit £1217, compared with £451—a result which Mr. Ginman points out is gratifying, more especially when all the circumstances are taken into consideration. Interest, sinking fund, and capital repayments were £155 more; and there was a reduction in the income from street lighting of £744.

The quantity of coal carbonized during the year was 9950 tons, being a decrease of 6·57 per cent.; whereas the corrected total quantity of gas made was 123,325,000 cubic feet, or a decrease of 3 52 per cent. There was thus a saving in coal used of 3 05 per cent., equal to a sum of £303 on the year's working. The make of gas per ton of coal carbonized was 12,394 cubic feet, against 12,003 feet in 1915, and 11,350 feet in 1914. Last year's make is the best yield per ton the department has ever had. The gas sold and accounted for, at 115,400,000 cubic feet, is a decrease of 3·41 per cent., due to the reduced consumption in the public lamps. In fact, whereas the total decrease was 4,084,000 cubic feet, the public lamps consumed 8,217,600 feet less than a year ago. Unaccounted-for gas figures at 6·33 per cent., as against 6 54 per cent. The gas sold and accounted for was 11,598 cubic feet per ton of coal carbonized, as against 11,219 feet in 1915, and 10,370 feet in 1914. The net profit has been apportioned as follows: Contribution in relief of rates, £350; working balance of £2678 raised to £3032. Mr. Ginman concludes by drawing attention to some improvements which he suggests should be paid for out of the working balance.

DUBLIN OUTBREAK AND THE GAS SUPPLY.

From the accounts of the happenings in Dublin in the days following Easter Monday, when the rising took place, it appears that the city was deprived, among other things, of its gas supply—a fortunate thing no doubt, in view of the huge conflagrations which arose during the time while the rebels were continuing their hopeless struggle against the forces of law and order. News to hand at the end of last week, however, was to the effect that it was hoped to resume the supply of gas on Monday (yesterday). Mr. William Newbigging, the Consulting Engineer to the Alliance and Dublin Consumers' Gas Company, has been over superintending the putting of matters right. It seems that at one time the works were subjected to the fire of the rebels, who riddled the holders with bullets; but when control was regained by those in authority, the work of preparing to restart operations was promptly proceeded with. The supply of electric current was, of course, also cut off.

Among the rebels upon whom, up to the end of last week, the sentence of death had been carried out, was "Major" M'Bride, the organizer of the Irish Corps who fought on the side of the Boers in the South African War. The correspondent of the "Weekly Dispatch" says that M'Bride held an appointment as Inspector of Water-Works under the Dublin Corporation, with a salary of about £600 a year.

COLCHESTER GAS BILL.

Special Committee's Report.

Absolutely without comment, at their quarterly meeting last Wednesday, the Colchester Town Council unanimously adopted the report of the Special Committee appointed by them some months ago to consider the steps to be taken in regard to the proposals contained in the Colchester Gas Company's Bill.

The Committee stated that they had held many meetings, and regretted that their efforts to come to an arrangement with the Gas Company relative to the inclusion in the Bill of a purchase clause had failed; the Directors having declined to discuss this question in any manner whatsoever. The only course open, therefore, was to proceed with the opposition. The Committee thought it well to mention that, in the course of the investigation of the Company's accounts, it had, among other matters, been ascertained that the Company had for many years past paid dividends free of income-tax—that was, they had paid higher dividends than empowered by law to do. They had also accumulated a large floating balance, and had expended for capital purposes upwards of £40,000, which should have been applied towards the reduction of the price of gas. Counsel and expert gas engineers and accountants had been retained.

It was anticipated that the Bill would be considered by a Committee of the House of Lords on or about May 9 (to-day).

EXAMINATIONS IN "GAS ENGINEERING."

The City and Guilds of London Question Paper.

The following were the questions put to candidates last Saturday week in the examination in "Gas Engineering," held under the auspices of the City and Guilds of London Institute. The Examiner was Mr. Samuel Glover, of St. Helens. Candidates were directed to confine themselves to one grade only, and not to attempt to answer more than eight questions in the four hours allowed. The maximum number of marks obtainable is appended to each question. Candidates were cautioned to avoid giving in their answers any particulars of processes used in the works in which they were employed which were not matters of public knowledge.

GRADE I.

1. Sketch, front elevation only, three settings of retorts, each with a different number of retorts, such as would be most useful to ring the changes economically on a works of 50 million cubic feet of gas per annum. Specify size of retorts, and show position and size of ascension-pipes. State weight of charge per retort, number of charges per day, gas made per bed per day, and weight of coke per ton of coals carbonized which would be available for sale after firing by the method which you propose should be adopted; also state how many settings (singles) you would require for the above annual production. [*50 marks.*]

2. Describe one of the good modern methods of charging and discharging horizontal retorts, and specify a full list of retort-house tools required by stokers who have to attend to all the work from furnace floor upwards. [*40.*]

3. How can the working temperature of retort-settings be increased, and with what general effect upon the various products of the coals destructively distilled within the retorts of such settings. [*35.*]

4. What is the process which is generally spoken of as gas condensation? Why, and by what means, is gas submitted to this process? [*30.*]

5. What is an exhaust control, where is it used, and why? Show, by the help of sketches, where it is fixed, and what effect its use has upon the gas made. [*35.*]

6. Sketch a cross section of a modern purifier box, and state how many such boxes as you describe would be required to purify successfully one million cubic feet of gas per day. Describe the material you would use, and state the chemical reactions which would be involved in the use of the material you describe in doing the work of purification. [*40.*]

7. Specify the work of a chemical assistant on a gas-works with which you are practically acquainted. Describe briefly the instruments which are used in carrying out such duties, and state the standards which are generally used. [*30.*]

8. What relationship should the storage capacity of gasholders bear to the maximum demand for gas in any one day? State what size of holders you would use for a given size of works, and sketch a cross section of the form of gasholder tank with which you are best acquainted. [*40.*]

9. If you were looking for a site on which to construct a gas-works for a new area of supply not previously provided with gas, what leading features would guide you in your selection? [*35.*]

10. What are the circumstances at the works and in the district of supply which influence the percentage of unaccounted-for gas, and how can they be controlled? [*35.*]

FINAL EXAMINATION.

1. Show, by drawings, front elevation, with mouthpieces and pipes, and sectional front elevation, showing settings and combustion chambers with connection to producer and regenerator, of a setting of eight horizontal retorts of suitable size and shape for burning-off heavy charges. Suggest what is, in your opinion, the best method of working such settings; state the changes brought about in results obtained by carbonizing coals in such a way as you suggest compared with lighter charges in smaller retorts; and discuss briefly the advantages and disadvantages of heavy charges. [*45 marks.*]

2. What is coal, and what special features of coal distinguish it from cannel and shale? What special features distinguish gas coal from other coals? What portions of the organic constituents have the effect when coals are destructively distilled of influencing (*a*) the quality of the resultant coke, (*b*) the quality and quantity of gas, (*c*) the nature and quantity of liquids, and how does the temperature of distillation affect the results? [*40.*]

3. Discuss concisely the advantages of the several modern methods of economically and regularly providing a supply of gas suitable for the every-day requirements of an industrial centre of a quarter of a million people. Include in your scheme water gas, and the prospect of connecting-on a supply of coke-oven gas of 250 million cubic feet. [*35.*]

4. What chemical composition of a carburetted gas do you consider most suitable for a town's gas supply where lighting is an important consideration during the whole 24 hours of a day? What instruments would you use in testing to ascertain its various qualities as made and supplied under the supervision of an established testing authority? [*35.*]

5. Describe, by the aid of sectional sketches, (1) the details and general arrangement of the apparatus on a gas-works within the exhauster-house; (2) the relationship of this plant to the other apparatus on the works, including governors and gauges, differential and recording. How many different methods of driving exhausters do you know? What are the duties of an exhauster attendant? [*30.*]

6. Show, by means of a drawing, using dotted outlines and ordinary text writing, an old-fashioned, badly-arranged gas-works, and then in continuous outlines, using the same site, and half as much land again, a works of larger capacity, stating make of gas in both cases, and in the new works show the proper relationship and order of plant. [*45.*]

7. Detail the staff, with necessary supervision required within the works, for the production of 2 million cubic feet of gas per day for the shifts to cover 24 hours, and state what relationship this has to the total cost of gas into the holder. [*40.*]

8. In the case of an inflammatory bomb being dropped upon the crown of a telescopic holder when the holder is full of gas and the crown sheets are pierced, describe the sequence of possible events, and state which description of gasholder and tank would sustain least harm from such an accident. [*30.*]

9. Enumerate the bye-products of a gas-works making coal gas and carburetted water gas, and state what are the best methods of realizing the utmost commercial value therefrom. [*35.*]

10. Draw in simple lines the plan of a gas-engine, and specify relationship of gas-bag to supply meter and engine. How does the gas exert its power in the engine, and what arrangements are made to ensure long-hour runs? Can the gas-engine be used for generating electric current for public and private lighting purposes? [*35.*]

EXAMINATIONS IN "GAS-FITTING."

The following were the questions put to candidates on Monday of last week at the examination in "Gas-Fitting" held under the auspices of the City and Guilds of London Institute. The Examiners were Mr. H. Kendrick, of Stretford, and Mr. R. Halkett, of Glasgow. In the instructions it was intimated that in Grade I. no certificates would be given to candidates on the result of this examination, but their successes would be notified; in Grade II., candidates must have already passed the practical test in that grade; and candidates for the Final Examination must have already passed the final practical test. The candidates were directed not to attempt to answer more than six questions in the three hours allowed. In Grade I., all candidates had to attempt questions Nos. 1 and 5; in Grade II., Nos. 4 and 7; and in the Final Examination, Nos. 5 and 8. The maximum number of marks obtainable is appended to each question.

GRADE I.

1. Why should a wet or dry gas-meter not be placed near a fireplace or boiler? State your reasons. [*30 marks.*]

2. What are the advantages of a gas cooking-stove over a coal-range? [*50.*]

3. Sketch and describe the best known makes of flat-flame burners. [*30.*]

4. Under what circumstances would you use iron, lead, compo, copper, or brass piping in your work? State your reasons. [*60.*]

5. Describe and state the uses of a regulating nipple, bunsen tube, mixing chamber, and air regulator in an inverted gas-burner. [*50.*]

6. State the various uses for which gas is installed in all classes of buildings. [*45.*]

7. Why is gas a good aid to ventilation? Describe one method with which you are acquainted of using gas for this purpose. [*55.*]

8. Describe a double-cased and packed cooker. What defects are likely to arise in daily use, and how would you remedy them? [*45.*]

9. Give a list and describe the tools required by a gas-fitter when fixing a slot gas-cooker: (*a*) When the gas supply pipe is wrought-iron barrel; (*b*) when the gas supply pipe is lead or compo pipe. [*30.*]

GRADE II.

1. Describe minutely the operations necessary when watering meters to ensure accuracy. What precautions are necessary to ensure that the supply of gas is in order after watering? [*40 marks.*]

2. Give a description of a flat-flame burner, a "C" incandescent burner, and an inverted burner. State the illuminating power of each when supplied with gas of 500 B.Th.U. quality, and at a pressure of 25-10ths. [*55.*]

3. If a chimney where a gas-fire or cooker is fixed has a down-draught, state how you would overcome the difficulty. [*60.*]

4. A house is to be fitted for lighting, heating, and cooking by gas. Would it be advisable to run one main supply or not? If not, how would you connect the various pipes at the meter to avoid condensation water getting into a dry meter, and so as to cause least annoyance should there be considerable condensation in the interior pipes? [*55.*]

5. How would you test the pipes in the foregoing question for soundness when no gas is procurable? Sketch and describe the apparatus you would use, and state the pressures you would employ. [*45.*]

6. Describe and sketch the apparatus you would use to obtain an equal pressure of gas on each floor of a building three storeys in height. [*45.*]

7. What type of shade or globe would you use on a centre pendant (*a*) in a drawing room, (*b*) in a dining room, and (*c*) in a living room in an artisan's house? Would you suggest any coloured globes? If so, state, in percentages, the effect of the common colours on the volume of light emitted by incandescent gas-burners. [*45.*]

8. Why is it desirable to have air and gas regulators on incandescent gas-burners? State your reasons. [*55.*]

9. Sketch a pocket pressure-gauge and explain how it indicates gas pressure. What is gas pressure due to? [*55.*]

FINAL EXAMINATION.

1. What are the merits of a gas-furnace, as compared with a solid-fuel furnace? [*50 marks.*]

2. What arrangements can be made when fixing a gas-engine to prevent oscillation of the gas pressure in the gas-mains? Make a sketch of apparatus in general use, and describe its working parts. [*55.*]

3. Explain the working of an automatic valve of a gas-steam radiator. Give a sectional sketch of one with which you are familiar. [*50.*]

4. Compare a gas-fire stove and an inset gas-fire. Under what conditions would you recommend the different types? [*40.*]

5. Make a sketch of a complete hot-water system on the cylinder principle, showing a gas-circulator fitted to the installation in the most suitable manner to obtain the best results. [*60.*]

6. Sketch, and fully describe, an arrangement of burners or lamps for lighting a closed-in shop window 16 ft. long by 12 ft. high by 4 ft. deep, arranged to show white goods, and such as will prevent steaming of the glass in cold weather. [*50.*]

7. State, step by step, how you would fix a geyser, and what size of water and gas supplies you would install for one supplying 2 gallons of hot water per minute. Is it necessary to fix a control cock on such supplies? State your reasons. [*45.*]

8. If a supply of gas is to be run from the gas-main into a house containing six rooms and the usual offices, and provision is to be made for twelve lighting points, two gas-fire points, and cooker point, what size of pipe would you use? State also, step by step, how you would fix the installation, and what precautions would be necessary to ensure satisfactory results. [*55.*]

9. Describe the "F.O.S." sign, and explain how it can be used for advertising purposes. [*45.*]

EMPLOYERS AND NATIONAL HEALTH INSURANCE.

In a paper which he read on Friday before the Textile Institute, Manchester, Mr. Henry Lesser, Barrister-at-Law, the Secretary of the South Metropolitan Gas Company's Employees' Provident Society, said he thought no one would challenge the hypothesis that employers had a direct responsibility, not to say interest, in the health of their employees. Long before its adoption by the Legislature, many employers had recognized, and given effect to, their moral obligations in this matter. Here was a purely domestic question, where both employer and workmen could unite in a task at once humane and sympathetic. Various schemes were formed; and as time went on, these provident societies, as they might be termed, developed with marked popularity. But though a large number of employers had taken a broad view of the industrial relationship, the majority had not; and the working classes generally were roused to take common action on their own behalf.

An important concession was obtained in the passing of the Employers' Liability Act of 1880; and the principle then recognized was extended by the passing of the Workmen's Compensation Act of 1906, which, in its turn, prepared the way for the more comprehensive scheme of the National Insurance Act of 1911. In many cases, the benefits offered by the State were less advantageous than those enjoyed under the various existing funds; and at the urgent instance of employees themselves, a strong claim to exemption from the Act was laid before the House of Commons, though unsuccessfully. Some of the works societies were thereupon wound-up; but in most instances the bond of sympathy between the employer and his work-

CANTEEN EQUIPMENT

Write for Illustrated List. JOHN WRIGHT & CO., Essex Works, BIRMINGHAM.

people had become too firmly welded to be so easily severed. Both parties applied themselves philosophically to the new problem, with the result that the initial difficulties which had at first seemed almost insuperable, were eventually overcome, and the existing schemes reconstituted to satisfy the requirements of the Insurance Commissioners. After nearly four years' experience, he could say with some authority that these societies had done their work admirably, and, so far as could be ascertained, with financial success.

Mr. Lesser then proceeded to describe shortly the nature of an approved society which may be run in connection with a particular employment. He remarked that his chief purpose was to assist employers towards a better appreciation of the useful work which might be, and, in fact, had been, done, by an Employees' Approved Society, rather than to discuss the somewhat elaborate details connected with its administration, and he then proceeded to give an outline of the most important duties of such a society, in order that the scope for the employer's interest and co-operation might be more clearly understood. It was pointed out that, as most, if not all, of the Committee of Management actually worked daily among the ordinary members, they were, in every sense of the word, truly representative, and should thoroughly understand what arrangements would most likely suit their fellow-employees, while at the same time conducing to the smooth and efficient management of the society's affairs. An employees' society was much more favourably constituted, and, thanks to the facilities afforded by the employer, could be run more cheaply and efficiently, than any other type of organization among approved societies. Admitting that much depended upon the geographical peculiarities of the particular enterprise concerned, Mr. Lesser urged that, in the case of an ordinary works or factory, where the great majority of the members resided within more or less easy distance of the place of employment, there was no doubt whatever that the general health standard of the employees might be considerably improved by the efforts of an employer who was sufficiently interested. Where an employer was of opinion that the number of his workpeople was too small to warrant the formation of an approved society, it was open to him, if practicable, to join with other employers in the same locality in establishing a provident fund for the benefit of all the employees concerned. Nearly all Employees' Societies, in addition to administering the State benefits, also had schemes of their own, independent of the National Insurance Act—superannuation, life insurance, and extra sickness benefit.

The author quoted letters he had received, as showing beyond question the splendid spirit of comradeship which the Employees' Approved Societies helped to cultivate, and how much they were appreciated by all who were connected with them. In his opinion, he concluded, it could not be too strongly emphasized that the social, no less than the economic, conditions of industry demanded the attention of employers of labour, since both were, in their respective degrees, complementary elements of the same problem. It was not sufficient to wait for a Government to say what must be done; employers should think out what could be done, and, when the course was clear, act promptly.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 8.

Pitch continues steady, and the price remains unchanged at 19s. to 19s. 6d. per ton, net, at sellers' works. There are still a certain number of shipments to be made before the close of the export season. Solvent naphtha, 90/160, is 2s 2d. per gallon, net and naked, at sellers' works. It is reported that a large quantity of creosote has been sold at 4⅜d. per gallon, net, in bulk at makers' works.

Fair quantities of sulphate of ammonia are being shipped on account of old business booked; but little new business is being done, and prices are quite nominal.

Tar Products in the Provinces.

May 8.

There is no alteration in the markets for tar products. Little or no business is doing in pitch. Creosote is still very quiet, and difficult to sell. Solvent naphtha is steady. Heavy naphtha is also in fair demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 15s. 6d. to 19s. 6d. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11½d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6¾d. to 7¼d. Solvent naphtha, naked, North, 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2¼d. to 2½d. Heavy oils, in bulk, 3⅛d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ¾d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *May* 6.

An improvement in the demand has been experienced since the beginning of the month, but supplies have been ample to meet all requirements, and a further small decline in values has been recorded. The closing quotations are £16 12s. 6d. per ton f.o.b. Hull, £16 15s. f.o.b. Liverpool, and £16 17s. 6d. f.o b. Leith. Some manufacturers have now modified their views with regard to the forward position, and would be willing to sell July/December delivery at a premium of 5s. to 7s. 6d. per ton on prompt prices, but there has not been much disposition to operate.

Nitrate of Soda.

The market has advanced further, and the spot prices are now 18s. 9d. per cwt. for ordinary, and 19s. 6d. for refined quality.

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Sulphate of Ammonia.

From another source it is stated that to-day's quotations are as follows: Outside London makes, £15 15s. to £15 17s. 6d.; Hull, £16 12s. 6d.; Liverpool, £16 15s.; Leith, £16 17s. 6d.; Middlesbrough, £16 15s.

COAL TRADE REPORT.

Northern Coal Trade.

The Northern coal trade is active, with a very strong demand; but shipments are impeded by the lack of ready steamships. There is a full demand, especially for steam coals, and the prices are kept high—much of the requirement being for export. Best Northumbrian steam coals are quoted from 47s. 6d. to 50s. per ton f.o.b.; and second-class steams are about 40s. per ton. Steam smalls are very firm, and at the high rate of 23s. to 30s. per ton. The production seems now to be normal, and it is readily taken up, even at the high prices quoted above, though there are deliveries on contracts below these figures. In the gas coal trade, the demand is also full; but tonnage supplies are not adequate, and the shipments are at times restricted. Best Durham gas coals are about 35s. per ton f.o.b.; second-class qualities vary from 28s. to 30s. per ton; and "Wear Specials" are from 35s. to 37s. 6d. It will be remembered, however, that there are large contracts at the lower "maximum" prices. The shipments beyond these contracts are just now restricted by scarcity of ready steamers, which seems to show itself most in the coasting trades. Freights are high. Gas coal from the Tyne to Havre is now about 45s.; and to London, near 15s. 6d. is quoted. The consumption of gas coal is now perceptibly less, but so far this does not seem to ease either the price or the freight. It is believed that some local contracts have been placed at rates such as the Price of Coal (Limitation) Act decides; and one for export. Coke is firm generally. Good gas coke is from 26s. to 28s. per ton f.o.b. The freight on coke is exampled by the fact that 62s. 6d. was paid, Tyne to Dunkirk, a few days ago!

To the Darlington Town Council last Thursday it was reported that the quantity of gas made during last year was 428,007,000 cubic feet (a decrease of 5,239,000 cubic feet on the previous year), and that there had been 2619 tons less coal carbonized.

At the last meeting of the Manchester Gas Committee, it was reported that satisfactory arrangements had been made with the Ministry of Munitions for the purchase of concentrated sulphuric acid to be produced at the Bradford Road Gas-Works.

The Swinton and Mexborough Gas Board are seeking authority of the Mexborough and Swinton Councils to apply for a Provisional Order to vary their Act so as to allow the raising of the maximum standard price of gas to 5s. per 1000 cubic feet. It is understood that the Councils each have a majority in favour of the proposal.

Gas a Necessity.

In the course of an inquiry which the Necessary Commodities Control Commission have for some time past been conducting in Sydney, the Australian Gaslight Company and the North Shore Gas Company were called upon to show cause why the present price of gas (3s. 10d. per 1000 cubic feet) should not be reduced. Counsel for the former Company protested that such an investigation was outside the jurisdiction of the Commission, as gas was not a necessary commodity within the meaning of the Necessary Commodities Control Act, and the price of gas had already been fixed by Act of Parliament. An adjournment was thereupon granted, to enable a legal decision to be secured. After hearing the arguments, Mr. Justice Simpson (Chief Judge in Equity) delivered on March 13 a reserved judgment in the application by the Company for an injunction to restrain the Commission from proceeding with the inquiry into the price of gas. He said the Gas Act of 1912 was passed at a time of peace, when no war was expected; the Necessary Commodities Control Act was a war measure, in force only during the war. To some extent the second Act was inconsistent with the first; for the earlier Act indirectly fixed the price of gas, whereas the Commission might fix it without any restriction. Whether, if the Commission should fix the price at 3s. 4d. or 3s. 8d. per 1000 cubic feet, this would affect the provisions of the Gas Act as regarded dividends, it was not necessary for the Court to determine. These provisions would, he thought, still remain in force. He refused to restrain the Commission from proceeding with the inquiry, and found that gas was a necessary commodity within the Necessary Commodities Control Act of 1914—that it could be made a necessary commodity by a resolution under the Act. Subsequent information was to the effect that the Company were appealing against this decision.

Marple Gas Engineer Complimented.—At last Wednesday's meeting of the Marple District Council, the Gas Manager (Mr. J. K. Law) was congratulated on the results he had obtained, especially with reference to the extensions of gas supplies to large property owners in the district; and his salary was increased by a substantial amount.

Sunday Pay at Leicester.—An application by the National Gas-Workers' Union for the payment of time-and-a-half for Sunday work was the subject of a report by the Gas Committee to the Leicester Town Council. It was stated that on several occasions the gas-workers, through the Union, had asked the Committee for the concession. The request was also embodied in a recent application for a war bonus. Now the Union desired that the question should go to arbitration; and the Committee felt that the whole Council should decide this. Alderman Smith moved that the Council agree to the suggestion of the Union, and that the matter be referred to the arbitration of Sir G. R. Askwith; the terms of reference to be arranged by the Chairman, Vice-Chairman, the Engineer, the Town Clerk, and the representatives of the Union. The resolution was agreed to.

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Too Much Light at Leiston Gas-Works.

Mr. J. A. Sullivan, the Manager of the Leiston Gas-Works, pleaded guilty at Saxmundham, last Thursday, to a complaint of not having screened the ventilators of the retort-house. A special constable said that he was on duty on April 11, when he saw a number of vivid lights proceeding from the apertures of the brickwork of the gas-works. There were about fifty apertures; and the lights illuminated the district for 100 yards. The defendant had previously been warned, about nine months ago; and since that date alterations had been made. The defendant said it was a most difficult thing to alter the arrangements, as the fumes might endanger the health of the men. He had taken great pains to screen the ventilators; and since the last complaint the openings and ventilators had been boarded and closed in. The men were now working under these conditions. A fine of 25s. was imposed.

Stockport Gas Matters.

At last Wednesday's meeting of the Stockport Town Council, the minutes of the meetings of the Gas Committee which were confirmed stated that a Special Sub-Committee appointed to consider the broad question of the application of gas profits to the relief of the local rates reported that they had carefully considered certain tabulated information obtained from other towns, and had resolved that, under present abnormal conditions, the question be postponed for the time being. The Gas Committee recommended the adoption of the report of the Sub-Committee; and this was agreed to. At a meeting a fortnight later, the Chairman of the Committee (Mr. J. Winter, J.P.), reported that, at the request of the Finance Committee, he had agreed to grant £10,250 out of the gas profits in aid of the rates. The Works' Sub-Committee reported that the Engineer (Mr. S. Meunier) had submitted certain suggestions for the installation of plant in the works, which he considered it was advisable to proceed with, in order to overcome the difficulties in relation to the shortage of labour, &c., due to the war. The Gas Committee resolved that the Engineer should prepare plans and obtain tenders for the proposed works.

British Trade After the War.—Among the resolutions adopted at the annual conference of the National Chamber of Trade, held at Cardiff, was the following, which was proposed by Mr. George Clarry, the General Manager and Secretary of the Cardiff Gas Company: "That, in view of the close dependence of industry, commerce, and trade upon scientific and technical knowledge, which has been demonstrated so forcibly during the present war, this Chamber is of opinion that, as an adequate preparation for the extension of British trade after the war, every possible effort should at once be made by the nation in the direction of establishing a better organized system of scientific and technical education in this country, together with suitable means for industrial research."

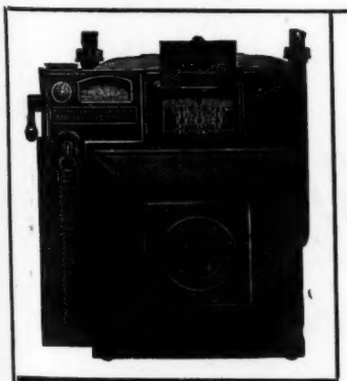
Manchester Gas Department War Benevolent Fund.

Reference to the excellent work of the Manchester Gas Department war benevolent fund was made in the "JOURNAL" for Aug. 24 last [p. 409]; and it is interesting to learn from a statement of the Treasurer (Mr. T. Williams) that the weekly subscriptions of the employees in the various departments for the period from Aug. 1, 1915, to March 31, 1916, amounted to £347 10s. 8d., to which a donor who desires to remain anonymous has added £20 conditionally upon his identity not being disclosed. Since the inauguration of the fund, shortly after the outbreak of war, the staff at the Town Hall have contributed to it £1042 11s. 2d., and the staff and men at the works £1879 18s. 5d.; the benevolent fund having been established for the benefit of members of the staff and workmen who might be injured in action, or to assist the dependants of the fallen. The trustees of the fund are Mr. Frederick A. Price (the Superintendent of the Department), Mr. Thomas Williams (Hon. Treasurer), and Mr. G. W. Kaye (Hon. Secretary).

Hebden Bridge Gas Board.—The annual meeting of the Hebden Bridge and Mytholmroyd Gas Board was held last Thursday, and appointments made for the coming year. Mr. James Simpson, J.P., who has been Chairman of the Board for fifteen years, stated that, owing to deafness, it was difficult for him to follow the business in hand; and he asked for a successor to be appointed. Owing, however, to the unique experience which Mr. Simpson has had in local gas business matters, his colleagues pressed him to again be Chairman; and he consented.

Manchester Gas Profits and the City Rates.—At Wednesday's meeting of the Manchester City Council, among the minutes of the Gas Committee that were confirmed was a resolution approving a decision of the Committee, at their meeting on April 19 (when the estimates on revenue and capital account were considered), that the sum of £50,000, free of income-tax, be paid during the year ending March 31, 1917, into the city fund out of the profits of the gas undertaking, in accordance with the resolution of the Council on April 1, 1914. By the resolution referred to, the Gas Department agreed to contribute the sum of £50,000 annually for at least three years.

Mansfield Municipal Undertakings.—It was reported at the last meeting of the Mansfield Town Council that the Gas Committee had estimated the possibility of contributing £1000 in relief of rates for the ensuing year. The Electricity Committee had promised the same amount; while from the profits of the water undertaking it was hoped to receive £2500. Gas workers and others in the employ of the Corporation having applied for increased wages, the matter was reported to the Board of Trade, with the result that the question was referred to arbitration. Those in receipt of 29s. a week or under are now to be paid an additional 1s. 6d.; while those in receipt of more than this sum, but not more than 40s. weekly, will be granted 1s. extra.



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High-Pressure Gas Plants.

High-pressure gas, for one purpose or another, is now so generally in demand that there are few gas-men who will not find something to interest them in the new "Gas Pressure-Raising Plant and High-Pressure Gas Transmission" catalogue of Messrs. George Waller and Son, of Stroud. The different types of machinery necessary to deal with different pressures are classified under three sections. In the first place, there are boosting plants for dealing with large volumes at relatively low pressures, for raising the pressure throughout a district or meeting the demand at time of peak load—for which purposes the use is advocated of specially designed high-speed gas-fans. In the next place, there are specially designed rotary compressors for medium pressures, up to about 5 lbs. per square inch, for increasing the capacity of existing mains or for delivering gas to a distance through mains of moderate size. Lastly, we have high-pressure transmission, for pressures over 5 lbs. per square inch, for which the reciprocating double-acting type of plant is recommended as the most efficient. Machines of all the kinds named are illustrated; and there are included some notes on the design of rotary gas-compressors which should prove specially useful to those contemplating the installing of plant. Particulars will also be found of other appliances useful to a gas undertaking, as well as tables giving capacities of mains of various diameters and lengths at different initial pressures.

Carnarvon Gas and Electricity Supply.—At last Tuesday's meeting of the Carnarvon Town Council, a financial statement dealing with the working of the Gas Department showed the expenditure for the past year to be £7681, as against £6519 in 1913; while the income amounted to £7784—compared with £7061—the net profit having dropped from £542 to £105. Last year the gas consumed amounted to 35,701,900 cubic feet, as against 31,436,000 cubic feet; and there was an amount of 4,162,000 cubic feet unaccounted for. It was announced that the sanction of the Local Government Board had been secured to the borrowing of £2680 for the extension of the plant at the electricity works.

Gas Profits at Silsden.—The statement of the past year's working of the gas undertaking of the Silsden Urban District Council shows a gross profit of £1214, as compared with £1182 for the previous year. After paying off instalments and interest on loans, and other charges of a capital nature, there is left a net profit of £131. During the eleven years ended March 31, 1915, the rates have been relieved to the extent of £3461. The balance in hand at present is £1303; and the outstanding capital £7340. It was stated that "the decision of the Committee not to increase the price of gas, in common with most other gas undertakings, maintained their position of being the only gas-works in the kingdom with as small an output, to sell gas as cheaply as 2s. 6d. per 1000 cubic feet; while the price of the coke, 15s. per ton, against 20s. at neighbouring works, was a boon to the consumers."

The Past Year at Blackburn.

References to the first annual report of Mr. A. Morton Fyffe, the Engineer and General Manager of the Blackburn Corporation Gas Department, have already appeared in the "JOURNAL" [*ante*, pp. 187, 236]; and at a meeting of the Town Council held last week-end, Mr. J. W. Holgate, the Deputy-Chairman of the Gas Committee, took the opportunity of drawing the attention of members to it. He characterized the report as a very able document. After referring with satisfaction to the increased yield from residuals, as compared with the previous twelve months, Mr. Holgate went on to allude to the success that had attended the adoption of the "forward policy" of the department, and laid especial emphasis on the value of the new show-room, which had been paid for out of revenue and was doing sound business. He had no hesitation in declaring that the new show-room was going to prove one of the strongest assets of the Gas Committee. Considering the tremendous difficulties overcome during the year, the results reflected very great credit on the management and staff. Although the price of gas had been increased and yielded a certain sum of money, the cost of materials had far exceeded this amount. He desired to express Mr. Fyffe's thanks to the members of the Council for the support they had given him. Mr. Higham said it was appropriate that they should discuss the report considering the criticism made as to the salary when the appointment of Mr. Fyffe was made. He thought that the Engineer's first report would fully satisfy every member of the Council that they were rightly advised, and that they were wise in offering the salary they did. If they had not done this, they would not have secured Mr. Fyffe. On one hand they were told that the whole of the profit was discounted because 7d. per 1000 cubic feet was charged extra for gas. This was not the right attitude to take up, because the increased revenue from gas amounted to £10,866, while the increased cost of raw materials amounted to £13,660. The report showed that the profit on the year was due to more careful management, and a better insight into, and handling of, the gas-works than they had had previously. The report was adopted.

Man Electrocuted at Bradford.—A fatality occurred on Thursday last at the Bradford Corporation electricity works; a man named Dickenson, who was employed at the switchboard, being electrocuted. Deceased was working at the Thornbury sub-station, when he touched a live wire, and received the full force of the current. He was thrown to the ground, and death appeared to be instantaneous.

Imperial Continental Gas Association.—In accordance with the provisons of the Association's Acts of Parliament, the half-yearly ordinary general meeting of proprietors will be held at the Cannon Street Hotel on Wednesday, the 24th inst. The Directors regret that, owing to the absence of returns from the stations, it will not be possible to prepare a report, balance-sheet, &c., in respect of the half year ended Dec. 31, and that consequently they are not in a position to recommend the declaration of a dividend in respect of that half year.

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The Treasury and a Manchester Water-Works Extension Scheme.—At the last meeting of the Manchester Water Committee, a communication was read from the Local Government Board intimating that the Treasury declined to sanction the raising of additional capital for the purpose of works at Mill Gill, Thirlmere, and Longdendale, and requesting further information respecting the contract for restoring the reservoir embankments at Audenshaw. It was decided to submit the particulars desired respecting the Audenshaw reservoirs.

Stokers' Wages at Gainsborough.—Vigorous comment was made by certain members of the Gainsborough Urban District Council, when the Gas Committee submitted a statement to the effect that they could not recommend any increase of wages for the employees at the gas-works. The Committee produced a list of wages—based on a twelve-hour shift and a seven-day week—showing that the rates in Gainsborough compared favourably with those prevailing elsewhere. The Chairman of the Committee (Mr. Beechey) having pointed out that two towns were paying more and five the same or less, Mr. Rose remarked that if the wages named were those paid to gas-fitters, stokers, and labourers, he did not wonder at the men asking for a rise. Mr. Scott said he understood stokers were being paid at the rate of 6d. an hour for an 84-hour week. He would not expect a man to work for 6d. an hour. Mr. Lobley moved that the matter be referred back to the Committee. "It was not every working man who would sell his soul for £2 3s. 3d. for a week of 84 hours." Mr. West asked if a certain town had been included in the list; and upon being told that such was the case, he said emphatically that some of the figures were "faked." The figures given in the case he alluded to did not represent the wages paid. The matter was referred back for further consideration.

Coal Supply Difficulties at Oldham.—At the last meeting of the Oldham Town Council, the Chairman of the Gas Committee (Alderman H. Wilde, J.P.) referred to the serious position of the department in regard to coal supplies. About 130,000 tons were required, and only 80,000 tons had so far been contracted for. Deliveries under existing contracts were, however, better than they had been, although they were still under what they would like. There was undoubtedly a reduced output of coal, and a largely increased demand for it. A member having raised the question as to whether water-gas plant would help them out of the difficulty, the Gas Engineer (Mr. Tim Duxbury) said it would cost 50 or 60 per cent. more to make water gas with oil at the existing price than to make coal gas, even at the present high price of coal. Alluding to the shortage of labour at the various works, Mr. Duxbury also reported that the number of stokers, labourers, and other inside employees was now 265, whereas at the corresponding period last year 345 were engaged. In the course of an appeal to consumers to be as economical as possible in the use of gas, Alderman Wilde pointed out that the department could not cut down the pressure, because of the gas used for power in the large munition works. He suggested, therefore, that people should go to bed earlier, and use as little light as they could do with.

Big Fine for Polluting a Harbour.—The Australian Gaslight Company were recently proceeded against for allowing offensive matter to flow into the harbour, and were fined £50, together with costs. It was stated for the Company, who pleaded guilty, that a pipe carrying tar to a tank had cracked, and the tar escaped into the harbour. Steps were immediately taken to stop the flow, and there was no recurrence of the trouble. The offence was due entirely to an accident. In reply, it was pointed out that the Company had been prosecuted twice previously for a similar offence, and on the last occasion promised to abate the nuisance, stating they were completing a big tank which would prevent the flow into the harbour.

Manchester and Daylight Saving.—Alderman Kay (the Chairman of the Manchester Gas Committee), dealing with the effect of the Daylight Saving Bill upon the habits of the people of Manchester, said that, if these were changed as easily as the hours, the approximate reduction in the consumption of gas in the city and suburbs would be 120 million cubic feet, equal to 2 per cent. of the output. There was a time when daylight saving might have had a serious effect upon the gas of the city; but nowadays the supply was becoming more and more a day load, as against any increased night load. The demands made by industry and manufactures—where exact temperatures were required—made gas in great request in the daytime. Years ago, they had not the gas-cooker and other appliances now used in the consumption of gas in the daytime; and it was on this account that the effect of the Bill, if passed, was not so serious as it might have been in times gone by.

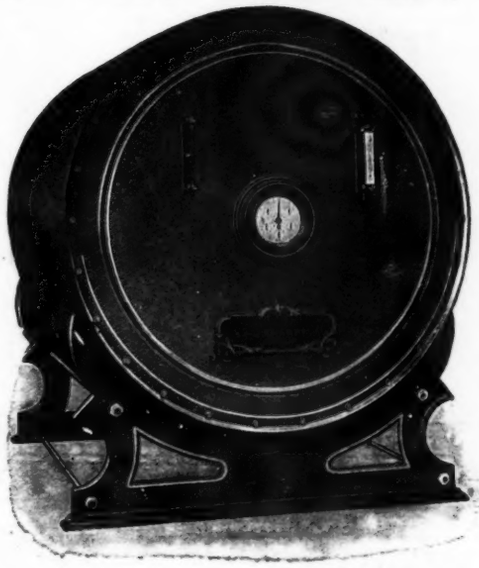
Saxmundham Lighting Contract and the War.—In connection with the report of the Lighting Committee, there was submitted at a meeting of the Saxmundham Urban District Council correspondence with the Secretary of the Gas Company with regard to the Company's claim for public lighting during the year ended Nov. 26, 1915. It appeared that, while the lamps were last lit on Jan. 22, 1915, and the Secretary had written stating that an allowance would be made for the period during which they were not lighted, the Company claimed for the full amount payable under the contract—viz., £97 8s. 4d., though they offered, without prejudice, to allow a reduction of £30. It had been pointed out to the Company that the number of days which the lamps should be lighted under the contract was 277, but that they had actually been lighted only 57 days; and that the amount due on the basis of the arrangement made with the Secretary was £20 1s. The gas consumed during the 57 days was estimated by the Company at 115 500 cubic feet; while the maintenance expenses and wages incurred by them expressly under their contract were stated to be £6 13s. 3d. As the charge of 5s. per 1000 cubic feet to consumers of gas was inclusive of the cost of fittings supplied by the Company, the Committee recommended that an offer of 5s. per 1000 cubic feet on the estimated quantity of gas consumed by the public lamps be made to the Company in full settlement. This recommendation was unanimously adopted.

BRADDOCK'S IMPROVED GAS METERS

No. 219. Braddock's Large Dry Meter.

SECOND TO NONE.

Made in all Sizes.



No. 245. Braddock's Large Wet Meter.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), **Globe Meter Works, OLDHAM,**

Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 815.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "METRIQUE, LAMB LONDON." Telephone No. 2412 HOP.

STOCK MARKET REPORT.

THE Stock Exchange has had another short week of five days, and a quiet one. The inactivity was no matter for surprise; the three great Eastertide tragedies—the Irish rebellion, the capitulation of Kut, and the Compulsory Service collapse of the Government—not being conducive to enterprise. But, making all due allowances, the general tone was satisfactory, and, moreover, it was progressive, and closed at its best. In the gilt-edged market, after a dullish opening, the position recovered, and the War Loan was firm; while Colonial issues advanced in response to a renewed demand. Home Rails could not muster up any animation; but they did not suffer from weakness. The Foreign Market furnished some good points. The French Loan had a very firm week; and Japanese, Brazilian, and Italian were well supported. Americans had a chequered time, with international questions and impending labour troubles facing them. Argentines were rather firmer on an improved outlook as to maize and other matters. South Africans were irregular, and closed dull. In the Miscellaneous Market, the feature was the backward movement of Rubber. The big strides in advance it has recently achieved have been beyond the bounds of produce, and a little timely check is a wholesome corrective. Shipping shares met with much attention. The question of our mercantile navy is one of the most important. Business in the Gas Market was moderate. Price, where operations were on a scale sufficient to afford indication of a tendency, inclined to be lower. Possibly this was influenced by the extraordinary letter of the Board of Trade to the gas undertakings desiring them to effect a reduction of 10 per cent. in the quantity of coal carbonized for lighting purposes, while Mr. Lloyd George is urging them to supply him with the utmost possible quantity of toluol and benzol! But the public have by now pretty well ceased to repose confidence in the wisdom of Government departments. The prolonged retention by the Treasury of the remaining minimum prices is causing great dissatisfaction to members of the Stock Exchange. It is regarded as not only productive of injustice, but as a wholly unnecessary measure.

Bargains done for cash during the week were as follows: On Tuesday, Continental Union 37, 37¼, Gas Light ordinary 74¾, 75, 75¼, 75⅜, ditto preference 74, ditto debenture 59½, 59⅝, Monte Video 8⅝, 8¾, North Middlesex 11⅛, 11⅛, South Metropolitan debenture 59¾, 60. On Wednesday, Gas Light ordinary 74⅛, 74¾, 75, 75⅛, 75⅜, South Metropolitan 77, Tottenham "B" 86. On Thursday, Gas Light ordinary 74, 74¼, 74⅛, 74⅜, ditto preference 74, 75, ditto debenture 59⅜, Imperial Continental 60, Newcastle 80, Primitiva preference 70s., 70s. 6d., San Paulo preference 8 7/16, 8½, Tottenham "B" 87. On Friday, Gas Light ordinary 73⅛, 74¼, 74⅛, Imperial Continental 60, 60⅛, Primitiva 38s. 9d., ditto preference 70s., South Metropolitan 77⅛, South Suburban debenture 91½. On Saturday, Bombay 5⅛, Gas Light ordinary 73⅛, 74¼, ditto preference 74, 74⅛, 75, Primitiva preference 70s. 6d., South Metropolitan 77, 77⅛, ditto debenture 60½.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	3 18 2	..
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	8/-	Bombay, Ltd.	5⅞—6⅛	5 17 8	6¼
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water { 10 p.c.	29—30	5 6 8	..
338,110	10	,,	7	7/-	B 7 p.c.	15—15½	4 10 4	..
115,000	10	,,	6	6/-	Pref. 6 p.c.	13¾—14	4 5 9	..
159,740	—	—	—	4	4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	56/-	Brentford A Consold.	261—266	5 5 8	..
734,920	,,	,,	†11	55/-	Do. B New	204—209	5 5 8	..
55,000	,,	,,	5	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,880	Stk.	Feb. 26	11	10⅝	Brighton & Hove Orig.	208—213	5 3 4	..
344,300	,,	,,	8	7⅞	Do. A Ord. Stk.	154—159	5 0 8	..
630,000	20	Mar. 26	12½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
345,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord.	108—110	4 10 11	..
1,513,380	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 3	..
560,000	,,	,,	5½	46/8	Do. 3½ p.c. do.	103—105	5 1 6	..
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	..
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	37—37⅛
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	—	—	—	11⅛	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	5⅞	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd.	17½—18	5 11 1	..
16,327,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke { 4 p.c. Ord.	98—102	4 15 6	73½—75½
2,600,000	,,	,,	3½	3½	3½ p.c. max.	76—79	4 8 7	..
4,062,235	,,	,,	4	4	4 p.c. Con. Pref.	96—99	4 0 10	74—75
4,674,850	,,	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	59½—59⅞
180,000	,,	,,	10	10	10 p.c. Bonds	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16⅞	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7½	7½	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅝	6⅞	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental	150—160	5 12 6	60—60½
1,235,000	Stk.	Feb. 12	3½	3½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
235,242	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 5	..
2,498,905	Stk.	Feb. 26	10	5	Liverpool 5 p.c. Ord. { A	211—213	4 13 11	..
					B	146—148	4 14 7	..
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	6 13 4	8⅜—8⅞
1,875,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	80
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	85—88	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8⅜	North Middlesex 7 p.c.	14—15	5 2 8	11⅛—11⅜
300,000	Stk.	May 14	8	8	Oriental, Ltd.	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7⅜—7⅞	6 9 0	..
60,000	50	Feb. 26	13	65/-	Portsea, Island B	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C	118—121	4 19 2	..
52,000	50	,,	10	—	Do. D	..	—	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	6 18 4	33/9
499,960	5	June 26	5	2/6	,, 5 p.c. Pref.	4¾—5	5 0 0	70/—70/6
521,600	100	June 2	4	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10¼—11	5 9 1	8 7/16—8½
125,000	50	July 1	5	5	5 p.c. Deb.	4⅞—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	233—234	4 9 8	..
209,984	,,	,,	10	10	Do. B	223—224	4 9 8	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African	10¼—11⅛	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	77—77⅛
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	59½—60⅛
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 8 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—113	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent.	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	91½
647,740	Stk.	May 14	5	5	Southampton Ord.	99—103	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham { A 5 p.c.	125—128	5 8 8	..
783,275	,,	,,	6	6	District { B 3½ p.c.	115—117	5 9 7	86—87
181,355	,,	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	103½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8½	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6¾	63/9	,, B 3½ p.c.	129—134	5 9 7	..
108,075	,,	,,	5/17/6	55/11½	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6¼	57/6	Wimbledon 5 p.c.	117—122	5 0 5	..
98,000	,,	,,	6⅜	63/9	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

† Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

SHOWROOM ASSISTANT. No. 6180.
GAS-FITTERS. Swansea Gaslight Company.
STOKER AND HANDY MAN (KIDWELLY). Applications to Willey and Co., Exeter.

Appointment Wanted.

GAS ENGINEER. No. 6176.

Plant, &c. (Second Hand), for Sale.

ENGINES AND EXHAUSTERS. Preston Gas Company.
PIPES, &c. The Controller, Post Office Stores Department, Bedford Street, London, W.C.
TYPEWRITERS. White, Northampton.

Plant, &c. (Second Hand) Wanted.

PURIFIERS. No. 6179.
PURIFIERS. No. 6178.

Meeting.

IMPERIAL CONTINENTAL GAS ASSOCIATION. Cannon Street Hotel. May 24. 3.30 o'clock.

TENDERS FOR

Coal.

GLOUCESTER GASLIGHT COMPANY. Tenders by May 30.
LEEK LIGHTING COMMITTEE. Tenders by May 26.
OLDBURY GAS DEPARTMENT. Tenders by May 13.
OXFORD GAS COMPANY. Tenders by May 15.
RICHMOND TOWN COUNCIL. Tenders by May 30.
ROTHWELL URBAN DISTRICT COUNCIL. Tenders by May 15.
SHREWSBURY GASLIGHT COMPANY. Tenders by May 26.
SKIPTON URBAN DISTRICT COUNCIL. Tenders by May 24.
STOKE-ON-TRENT GAS DEPARTMENT.
TIPTON GAS DEPARTMENT. Tenders by May 16.

Oxide (New and Spent).

SKIPTON URBAN DISTRICT COUNCIL. Tenders by May 24.

Painting.

LITTLEHAMPTON GAS COMPANY.

Sulphuric Acid.

LEEK LIGHTING COMMITTEE. Tenders by May 26.
SKIPTON URBAN DISTRICT COUNCIL. Tenders by May 24.

Tar and Liquor.

LEEK LIGHTING COMMITTEE. Tenders by May 26.
SKIPTON URBAN DISTRICT COUNCIL. Tenders by May 24.